PRINCIPLES

OF

NATURAL AND METAPHYSICAL

PHILOSOPHY,

INTENDED ON

A MORE ANCIENT, COMMON-SENSE, AND POPULAR PLAN,

AND

MORE CONSISTENT ALSO WITH LATER IMPROVEMENTS THAN

THE

CARTESIAN OR NEWTONIAN;

COMPRISING

A Review of the prevailing Systems now taught, wherein it is meant to diminish certain Difficulties, which encumber them; more particularly in respect to a First Principle; Skeptical Tendency; the Nature of Light, Electricity, Magnetism, Heat, Caloric, Fire, Galvanism, and Electro-Magnetism; the Principle of Life; and to vindicate the Existence of the Soul, by Showing that there can be no such thing as Spirit, whether Human, Superhuman, or Supreme, unless it have some Corporeity, however simple or immaterial, in Opposition to those Cartesian Principles, which have given such fruitful Rise to Modern Infidelity.

By Marshall Tufts.

That extensive branch of science—metaphysics—has in modern times been unjustifiably separated by many philosophers from the division of physics or natural philosophy.—And I may add, that it is very much in consequence of so unnatural a divorce, that the science of metaphysics has too often licentiously allied itself to imagination, and brought forth a monstrous and chimerical progeny. *Book of Nature*, Lect. I. Series 3.

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1829.

TO THE

MEMBERS OF HARVARD UNIVERSITY,

IS THIS WORK RESPECTFULLY INSCRIBED

BY AN

ALUMNUS OF THE SAME,

THE AUTHOR.

Cambridge, May, 1829.

" Go, little book, from this my solitude;
I cast thee on the waters; go thy ways;
And if, as I believe, thy vein be good,
The world shall find thee after many days."

CONTENTS.

N. B.—Page 1, for 'so enveloped,' read 'more enveloped,' i. e. artificially. Page 5, for 'in,' read, 'is.' Page 9, for 'all other substances,' read, 'all material substances.' In respect to magnetic polarity, the phenomena of the dipping needle may not disconcert our theory, as a diversity of temperature, constituting different degrees of electricity or magnetism, may in a sense be extended into the earth as well as over its surface, the interior of the earth under the torrid zone being cooler than the surface, and under the frigid zones, oftentimes much warmer, or in either case to a degree corresponding to the dip of the needle. Pages 88 and 89, for 'origin of motion,' read 'mechanical motion,' i. e. which is inferior to that caused by spirit, established at creation, and supervised by a general Providence. In the article on Animated Nature, let not the agency of fire encroach too much on that of a higher principle, as too inadvertently intimated from a too great regard at the time to Newton's hypothetical spirit or ether. Fire and animal heat may, indeed, concur in some measure to the production of motion in obedience to the will by preparing the body thereto in rendering it more flexile and susceptible of action; yet the soul must be considered as the principal and immediate cause. Electrical agency may not be at all discoverable in the natural motion of animals. The manner, in which the soul is united to the body and immediately productive of its motions, is indeed, mysterious, yet if we consider it as co-extended with the body, subsisting chiefly in the brain and nerves, and possessed of a certain inherent power of dilatation, contraction, or other motion simultaneous with will, and sufficient to produce a corresponding motion in the body, the mystery is in some degree lessened. The nature of the soul may also have something to do in the production of animal heat, judging from what is often produced by mere passion, as in a flush of shame, anger, or surprise; especially, if as anciently supposed, there be a certain igneous quality in the nature of spirit. Nor even from plants may every other principle of life be excluded but what consists in mere matter. In respect, moreover, to the tides, let not the moon be cast too far into the background. We find on further consideration, that she may be of special use in raising a tide during the sun's absence, the second tide in the course of twenty-five hours, and after the sun's repulsion has passed along with him over the sea; then that of the comparatively stationary moon may follow after; since we can hardly suppose, that the sea is so elastic as to arise from a mere rebound. It is the electric repulsion of the sun and moon combined and acting successively, that may produce the tides. Page 89 'silent, motionless,' omit. And for the pronoun 'I,' in sundry places out of quotations, read 'we;' and for such phraseology, as, 'I think,' read 'perhaps;' it is a Cartesianism, which the author inadvertently fell into, and although somewhat more certainty might possibly be attached to the phrase in certain places, yet, according to general use and consent, by no means the fundamental importance of a *first principle*. Some of these imperficiences may be the more pardonable, as this part of the work was written some years since, while a Senior-sophister, after the German custom. (A Treatise on the Nature and Effects of Light, Heat, Electricity, and Magnetism, &c. 1827.) The other parts, being more the result of professional study, are perhaps of more worth.

FIRST PRINCIPLES.

Good's Book of Nature, and Butler's Analogy, have, in some measure, broke the way to a restoration of those original principles of science, on which modern speculation has too often and too presumptuously innovated. The tendency of these popular works, to which we more particularly refer, is to a connexion of metaphysics with physics in one general system, aptly called "the universal science," since it comprehends all things, natural and spiritual; a connexion in respect to analogy, whereby some comprehension at least of things invisible may be gathered from things visible or literally known. Who would think of beginning to build at the top of an edifice? or that it was of no consequence whether an edifice had any foundation at all? of soaring into the regions of intellect and utter abstraction for the first principles of science? Yet, if we examine the subject, we shall perhaps find, that so far as any first principle is concerned in whatever is more characteristic of the superstructure of modern physics and metaphysics, such is too often and too really the case.

But "to do something to instruct, yet more to undeceive the timid and admiring student—to excite him to place more confidence in his own strength and less in the infallibility of great names—to help him to emancipate his judgment from the skackles of authority—to teach him to distinguish between showy language and sound sense—to warn him not to pay himself with words—to show him, that what may tickle the ear or dazzle the imagination, will not always inform the judgment—to dispose him rather to fast on ignorance than feed himself with error,"—has long since be-

come a motto in our thriving age for the advancement of that liberality of sentiment, which is growing into results more and more auspicious, and which no where finds such an asylum as here. But there is an extreme in free inquiry to be especially avoided; a too licentious speculation; a reckless vanity of intellect, prone to transgress the laws of common sense, and the general understanding of mankind; a spirit favorable to aristocracy or the *condemnation of the populace*, so opposed to our political institutions; yet the grand fault, which has extensively prevailed in Protestant times, whatever may have been the benefits of the Reformation, and more peculiar perhaps to modern bigotry, than to the free-thinker. We here refer, more particularly, to an enormous gulf between things physical, and metaphysical, or spiritual, set off by speculation, and which, as if by Satanic influence, has long been widening to the almost entire removal of any shore, or any existence in the latter more than what is nominal; a reduction of substance to quality; a tendency to mere materialism and infidelity. Who now hears any thing about pneumatology in metaphysics? Who, indeed, is allowed to indulge the least conception of such a thing as *spirit*, by forming any idea thereof from analogy or things sensible, the only way in which any idea whatever may be formed; the only source of science, or from which the very name is derived. (Science, sense, scio, *ἴσω*, idea, *ἰδέω*.) Even the word, metaphysics, has grown old-fashioned, because it may imply perhaps somewhat of spiritual existence, or some analogy therein to things physical; the more current phrase, intellectual, has long been transplanting it. So the terms, soul, spirit, ghost have given way to the term, *mind*, because this implies something more intellectual or less tangible; perhaps, indeed, those terms would now be wholly unheard-of, were it not for the sanction of Scripture, where as in all original languages, they are universally used instead of a corresponding word to the term, *mind*, which is derived from other terms, (as, mens, *νόος*, gemind,) denoting a mere intellectual faculty of the soul, rather than the soul itself, or any distinct essence whatever. In the Encyclopædia Britannica, under the article Metaphysics, we read: "By pneumatology, metaphysicians mean the knowledge of all spirits, angels, &c. It is easy to conceive, that

infinite art is necessary to give an account of what we do not absolutely know any thing, and of which, by the nature of the subject itself, we never can know any thing." But if all this be admitted, where is Christianity? where is that characteristic faith, which is "the evidence of things not seen"? or if there be a spiritual entity, "what recks the world to know" any thing about it, for where is the application of a doctrine wholly beyond the sphere of human comprehension? Surely, then, we may not altogether deplore the progress of materialism under such a state of things, or any other means of bringing men to look after this subject, to break this Satanic spell on Christian knowledge, this glamour of magic. "It is high time," says Dr. Good, "to be more accurate, and to have both determinate words and determinate ideas."

But it is not enough to make these ravages in spiritual entity, a crusade has been levied against the existence of matter also, in this chaos of modern speculation, this airy castle-building, this driving of the crazy ship without a helm. How can men expect to move the world with Archimedes' lever without something to stand upon? What hazard from this neglect of a choice of ground lest the enemy seize upon it first, and themselves be hove from the field where their banners are now floating. It is said, that we know no more of matter than of spirit; the first principles of knowledge being placed in the internal operations of the mind, distinct from sense, in the single word, *Cogito*, that is, I think, the famous dogma of Descartes, (Princ. Pars. I.) gratuitously assumed in open defiance of common sense and the universal consent of mankind. Yet even so the Edinburgh Review; (Jan. 1804.) "It has been said, that we have the same evidence for the existence of the material world, as for that of our own thoughts or conceptions.—Now this appears to us to be very inaccurately argued. Whatever we doubt, and whatever we prove, we must plainly *begin with consciousness;* that alone is certain—all the rest is inference." Thus, the evidence of sense and our knowledge of matter are cast below our knowledge of mind, however uncertain this may be; and that too, on the evidence of a certain consciousness, so called, which is wholly distinct from sense; an internal operatian of mind, evidently consisting withal of "such

stuff as dreams are made of." The term, consciousness, instead of cogitation, or mere speculation, is thus artfully superinduced to gloze over in some degree the imperficiences of this system. Consciousness is derived from sense, or may not be fairly used to denote mere thought, the proper foundation of the system, for we are never so conscious of any truths, as of those derived from sense. Hence this term is not wholly synonymous with "thoughts, conceptions," or the principle, Cogito; which in fact gives to the fantasy of the lunatic, the temporary impressions of the poet and novel reader, and to every idle dream, a reality superior to that of immediate sense; so wild is this speculation, and so blind has been the reception of it.

In latter years, however, metaphysicians have been rather disposed to wave in some measure an open profession of this principle, or indeed of any first principle. Dr. Reid, after discovering some of its absurdities, openly allowed, (Inquiry into the Mind, chap. 7.) that we "must admit the existence of what we see and feel as a first principle, as well as the existence of things whereof we are conscious;" whence his pretended, common-sense system. But how far has either he or his successors practically admitted this innovation on Cartesianism? "Mr. Stewart, "says the Edinburgh Review, (Jan. 1804) "answers with irresistible force, (that is, to the objection of the materialist against the gratuitous assumption of the existence of mind,) that the philosophy of Dr. Reid has in reality no concern with the theories, that may be formed as to the causes of our mental operations, but is entirely confined to the investigation of those phenomena, which are known to us by internal consciousness and *not by external perception.*" The evidence of sense being, after all, so far neglected, what wonder at the dogma, that we know no more of matter than of spirit, and that "of the essence of matter we know nothing"?

"Is the essence of the human soul," says Dr. Good, (Book of Nature, Ser. 3, Lec. 1,) "material or immaterial? The question, at first sight, appear to be highly important.—Yet, I may venture to affirm, that there is no question, which has been productive of so little satisfaction, or has laid a foundation for wider and wilder errors within the whole range of metaphysics. And for this

plain and obvious reason, that we have no distinct idea of the terms and *no settled premises to build upon.*—Of the essence of matter we know nothing: and altogether as little of many of its more active qualities; insomuch, that, amidst all the discoveries of the day, it still remains a controvertible position, whether light, heat, magnetism, and electricity, are material substances, material properties, or things superadded to matter and of a higher rank. If they be matter, gravity and ponderability are not essential properties of matter, though commonly so regarded. And if they be things superadded to matter, they are necessarily immaterial; and we cannot open our eyes without beholding innumerable instances of material and immaterial bodies coexisting and acting in harmonious unison through the entire frame of nature. But if we know nothing of the essence and but little of the qualities of matter, of that common substrate, which is diffused around us in every direction, and constitutes the whole of the visible world, what can we know of what is immaterial? of the full meaning of a term, that, in its strictest sense comprehends all the rest of the immense fabric of actual and possible being, and includes in its vast circumference every essence of every other being as well below as above the order of matter, and even that of the Deity himself?"

But if we know nothing of the essence of matter, we know nothing at all; for what is the plain, original meaning of the word, essence, (esse, essentia, ens, οὐσια,) but being or existence itself? And what then is the essence of matter, but matter itself, the very existence of matter, of which, if we know nothing, no sense can constitute knowledge? Some effort is indeed made to darken this evident meaning of the term; or rather no meaning at all is of course attached to it, when it is said, that we know nothing about it, yet even the eminent author, in the above passage, acknowledges this meaning, when he calls the essence of matter, "that common substrate, which is diffused around us in every direction and *constitutes the whole of the visible world.*" A simple essence may exist in a compound essence, and be extracted therefrom, as in processes of distillery and a certain use of the term in domestic life, but the mechanic craft has been far outstript by this of philosophy, which has hypocritically refined upon the subject,

until it has refined it wholly away, or out of all entity whatever, and given currency to "one of those remarks, which are repeated, till they pass into axioms, only because they have so litle meaning, that nobody thinks it worth while to refute them at their first appearance." But how mysterious and unaccountable, that rational men should thrust into the most recondite parts of philosophy, or out of all existence, what constitutes the most obvious, self-evident, and universally acknowledged first-principle of all human science. For it is founded on immediate SENSE; OUR FIVE SENSES. Here is the first principle of science; too obvious, by universal consent in every age and clime, to admit of a momentary doubt; and it involves a knowledge of the essence of matter. Hence, if there is any real knowledge to be got on the subject of spirit, or metaphysics, as well as physics, it must be built on this foundation, by a certain analogy or connexion; and "that extensive branch of science," in the words of the author above quoted, (ib.) "which is generally known by the name of Metaphysics, has in modern times been unjustifiably separated by many philosophers from the division of Physics or Natural Philosophy; and made a distinct division by itself. As a part of Physics or Natural Philosophy, it was uniformly arranged by the Greeks; as such it occurs in the works of Aristotle;—And I may add, that it is very much in consequence of so unnatural a divorce, that the science of Metaphysics has too often licentiously allied itself to imagination, and brought forth a monstrous and chimerical progeny."

On this ground, we shall proceed to run over the more prominent and unsettled points in prevailing systems. As to that connexion of Mathematics with Physics, which has also grown out of these perversions, and covered over a flower garden with weeds, that straining at a gnat and swallowing a camel, that glozing over of a wound unprobed to the bottom, that stirring of dust to conceal defects, that laborious endeavour to supply the accuracy so much wanted in Cartesianism, by the superinduction of mathematical on intellectual speculation, *which* is the driest and most unedifying? or how has the matter been mended, or not rather made much worse? Newton's Principia Mathematica has succeeded the Principia of Descartes. Observe the sceptical conse-

quences of the latter in the country where it arose, until it so eminently concurred in the production even of that national misery, so awfully depicted on the page of history, in the Reign of Terror! Observe, also, how the former too has gained so much currency and fashion from the same nation, the same times, and similar causes! "In the sciences, " says Madame De Staël, (In. Lit. vol. I, c, 6.) "and particularly in mathematics, France can boast of the greatest men in Europe. The *civil commotions* amongst the French, far from discouraging emulation in this line, have inspired a wish to *take refuge* in the study of it.—Men of reflection, *disgusted* on all sides by the follies of *party-spirit*, attach themselves to these studies." Thus no sooner had Cartesianism got such mischief into operation, than Newtonianism must step in. Equal consequences have not followed, yet many are the groans of youth under it cramping chains. There is, indeed, scarcely any science it has not invaded; (ib.) theology, morality, metaphysics, political economy, (Say,) medicine, have all met and repelled the attack. But poor, natural philosophy has suffered a complete conquest, inasmuch, as she was more beautiful and tangible in her diversified and sensible nature, she lay more open to the invasion; the natural has become the artificial; the noble and desirable, the dearthy and uninteresting; the simple the complex; the intelligible the unintelligible. Some of these facts may appear more clearly in the sequel. Neither Newton nor even Bacon, if with all their apparent accuracy they proceed on any first principle, pretends to any other than that of Descartes, although the experimental character of the Novum Organum would appear so necessarily to require that of common sense. And is not this a reason why Baconism too, if we may be allowed the expression, has with all its benefits so often degenerated into a kindred speculation, which by a dearthy farrago has so often made physics unpopular? while Bacon himself, at the outset, has fallen into the grand error of pretending to avouch the immateriality of heat? (Reply to Ed. Rev. ag. Ox.)

ON THE MATERIALITY OF FIRE.

Of all the phenomena of matter, none are so wonderful, so distinct, or general, as those produced by what are called the imponderable agents—light, heat, electricity, and magnetism. Not a vapour ascends from the face of the earth; not a flash of lightning crinkles through the atmosphere; not a sunbeam cheers animated nature, or a ray of light discovers to us a star of the firmament, but from the immediate influence of one of these agents. Indeed, it is impossible for us to strain our imagination so far as to conceive of the dearth and desolation which must follow, if the earth were divested of heat or light even for a moment. All the dreariness of winter is the consequence of only a slight failure of these two agents, and all the gaiety of the summer landscape recurs again, when they prevail a little more plentifully. The soul springs from the human body, and leaves it a frozen clod, when a partial absence of caloric in the surrounding atmosphere draws away its quota of vital warmth.

Hence, there is no subject in physics of such fundamental importance as that which treats of the nature of the imponderable agents, as it must involve an account of the causes of the most general and astonishing effects in the physical world. Yet, strange as it may appear, even in this advanced age of experimental philosophy, when so much has been said and done respecting each of these agents, and the arcana of nature have been so incessantly sought after, there is not a subject in all our books of philosophy so enveloped in obscurity as this. Even their materiality is doubted. There is not one of these agents

whose materiality has not been strongly doubted. Light is called intangible, and all the others are said to be invisible, and in some of the latest works on natural philosophy, which have been published in this country, it is said, that if any of them consist of any matter at all, its nature is wholly unknown. (*Cambridge Physics, Mech. p.* 8; *Mag. p.* 194; *Elec. &c.*)

Considerations like these are sufficient to excuse any one, who thinks he can offer any thing clear on the subject, for making the attempt, though it should prove unsuccessful, and also for taking his own way to do it in, since if he falls into the place which the latest experimenters have left, looking up to them only, or is preestablished in the conviction of the truth of all the prevailing notions on this subject, although a thick obscurity is acknowledged to invest it, his hopes of much improvement cannot be very bright.

In the first place, then, it is well known, that all these peculiar agents are akin to one another, and possess many of their properties in common. All of them are equally subtile and imponderable, have an equal power of evading our grasp, and are almost wholly unlike to whatever else we see or feel; yet some of them are better known than others, and by endeavouring first to search into the nature of these, we may be more likely to detect the nature of the others. Heat, or caloric, is probably the best known; it is, at least, the one on which philosophers have dwelt the longest, and whose effects are most common and palpable. But what is known of the real nature of heat? Very little, certainly, if it is nothing at all, and nothing real it must be, if it is no material substance, unless we call it a spiritual agent, which would be altogether unwarrantable. What is neither matter nor spirit can be nothing real. Is heat then any thing or not? That it is not spirit, I think may be asserted without adducing proof. Is it any thing material? It is most surely, and all assertions to the contrary appear to be wholly groundless, as may be easily shown.

The singular doctrine of the "mechanical hypothesis," which supposes that the effects of heat are produced by no material substance, but by the motion of the particles of material substances, received one of its first sanctions from the pen of Francis Bacon, who in his Novum Organum asserted, that heat was merely "the effect of an intestine motion or mutual collision of the particles of the body heated;" as, for instance, a piece of iron, when violently hammered, becomes hot merely in consequence of the motion impressed upon it. Instances of the developement of heat by hammering, friction, or pressure, are the principal ones, that can be adduced to give this doctrine any plausibility; but to show its fallacy even here, once allow that mere motion is capable of producing such effects, then take a piece of sponge and press some drops of water out of it, and say, that this water is produced by the motion of the sponge, and would not the assertion be ridiculous? But is not the case analogous? Again, say that the fluid which is expressed from fruit by pressure is created by this motion, and is it not similar to the assertion, that the heat of a piece of iron is created by the motion it undergoes beneath a hammer? Are not the effects in both cases equally palpable? And if motion can produce the one, can it not the other? Indeed, it is well known, that by friction, pounding, or pressure, water or moisture may be elicited from any vegetable or other matter, in which it existed before in a concrete or invisible state; and therefore, is not the production of heat in a similar way a proof of its fluidity or materiality, rather than of its immateriality?

As we consider this doctrine further, its absurdity becomes more and more apparent. According to the "mechanical hypothesis," the intensity of heat is said to correspond to the degree of motion in the body heated; consequently, red-hot smoke, by which we understand flame, must be possessed of a very intense motion; but can this be shown to be a fact? Is

not the very opposite most certain? For is there any thing more sluggish or languid in nature than the motions of smoke? Any substance of sufficient density, a piece of metal for instance, becomes red-hot on being placed over flame, while at the same time it remains perfectly still and inactive. Who will affirm, that this heat is occasioned merely by a rapid intestine motion in the metal? What should cause this motion? Can any one perceive any such motion by means of the finest microscope? Is it not then an idle imagination, contrary to the dictates of the bluntest perception, which teaches us, that the heat passes from the flame into the metal? Confine water in a bottle, and agitate it with ever so rapid motion, and little or no heat is produced, while other substances may be heated red-hot without the least apparent motion in them, unless it be that of expansion, which is a direct consequence of the insertion or internal action of a material substance. Whence this strange inconsistency? If motion can create heat in one instance, can it not in another? How is it that the intensest heat is almost always attended with no apparent motion in the body heated, while on the other hand the intensest motion is often unaccompanied by any perceptible heat? Did any one ever know the mere motion of the sea or atmosphere to produce heat in those bodies? Is not air or water generally quiet, when it begins to grow warm? Are not the waters of the ocean, which almost cover our globe, in perpetual and oftentimes the most violent motion, and are they not very cold? Do waters boil for heat at the foot of a cataract?

Rumford and Davy have endeavoured to support this hypothesis. Rumford made some experiments of boring brass metal, in which he observed, that the heat produced by the friction was constant, as long as the friction continued; hence he concluded, that the supply of heat from the brass was exhaustless, which could not be, if it was material. But what right had he to make this conclusion? Could the process of

friction be carried on perpetually? By no means, for whether it be slow or swift, the body which is wrought upon must eventually be worn wholly away; but supposing it was not, could it be shown, that the heat was never derived in any measure from other bodies in contact, and if from no other source, even from the hands of the persons who wrought the friction?

Davy observes in his "Elements of Chemical Philosophy," that, "when any body is cooled, it occupies a smaller volume than before; it is evident, therefore, that its parts must have approached toward each other; when the body is expanded by heat, it is equally evident, that its parts must have separated from each other. The immediate cause of the phenomena of heat then in motion, and the laws of its communication are precisely the same as the laws of the communication of motion." Consequently, if you put your hand into a tumbler of water, and the water rise or swell around it and sink again, when you withdraw it, your hand is not the cause of the rising and subsiding of the water, but motion, the effect, is the cause of it. This is a direct inference. Now causes and effects should be distinguished from each other. Davy has here adduced a strong proof of the materiality of heat; for in the first place can any motion take place except in consequence of the immediate application of some substantial force? Then, when a body is held perfectly still over a flame, and expands on being heated, what is it that pushes apart its internal particles which "must have separated from each other" during the expansion? Is it not some material force within the body? Certainly; and it is applied in the same way as the material power or fluid, water, is, when it expands porous bodies on being absorbed into them; or the fluid, air, when it is introduced into a bladder. Would it not be absurd to say, that it is not the air which enters into a bladder that expands it, but motion alone? Yet is it not precisely the same to assert, that the ex-

pansion of heated bodies is not occasioned by any material force or fluid, which enters them, and pushes apart their interior particles, but by an invisible motion merely?

Indeed, is it not astonishing, that a doctrine, like that of the "mechanical hypothesis," should ever have found credence in a reasonable mind? Yet Newton is said to have favoured it, though some have attempted to account therefor by querying, "whether Sir Isaac did not think it his interest to get rid of this powerful element, or, at least, to reduce it so low in the estimation of his readers, that it should never be able to do his system any harm."

In addition to what I have stated in favour of the materiality of heat, a generally received truth, and the analogy of its phenomena to those of other fluids in cases enough to establish the fact of its own fluidity, there are other very obvious considerations, that prove it to be matter. What is matter? It is "the subject of our perception," the perception of our senses, and metaphysicians tell us, that there is not one of our senses whereby we obtain so certain knowledge of the existence of material things, as by our sense of muscular feeling. And what is there in nature, which recommends itself so strongly and so constantly to our sense of feeling as that very common thing, heat?

But supposing, heat is sometimes visible, or rather always so, when it exists in the greatest quantities; then we have another proof of its materiality, if another proof were necessary to establish this point, resulting from the evidence of vision as well as feeling. And, indeed, when a body is heated red-hot, what is it that produces the redness and the brightness? Is it not "luminous caloric" only? In red-hot smoke, for instance, what is it that constitutes the fire of the flame, but caloric? It is very natural to suppose, that when heat dwells in opaque matter in small quantities, it should be concealed from view, for even water is in this case invisible, and air also, but when the quan-

tity of heat in a body is increased so as to exist in abundance, a brightness is occasioned, so great as to almost overpower our vision; and is it not most obvious, that heat produces this, and of course has become visible and constitutes fire? Will not invisible vapour become visible in the same way by being condensed or increased so as to become water?

It may be said, that light is combined with the heat in fire, and produces the visibility? But what does light consist of, except the matter of heat? Is not light a warm as well as a visible substance, since its warmth always increases with its intensity? Is it not of the same colour as the intensest heat, which is white, as in platinum, and of the purest fire also, which is perfectly white? Even the burning vapour of a common lamp is full of a white heat or fire very nearly the same in colour as the light, which is constantly proceeding from it. What are the strong arguments, which, in opposition to this obvious evidence, should authorize the assertion, that light and heat are two, distinct elements? It is said that light and heat may be sometimes separated from each other, and therefore, they are distinct elements. For instance, it is said, that there is less heat in the spectrum or shadow of a prism, than there is immediately out of it; next the red colour; but is this any argument at all? Who does not know, that there is always less heat in any shadow than there is immediately out of it, and for this very plain reason, that there is less light in every shadow than there is out of it? Is not any of the light, which falls on a prism, reflected or obstructed from passing through it? Of course then, there is less light in the prism's shadow than out of it, which favours the identity of the matter of heat and light rather than the reverse, by showing how regularly the degree of the one corresponds to the degree of the other. Even in the shadow, greater heat prevails, where greater light does, that is, among the lighter and brighter colours, red, orange, and yellow.

Again, it is said, that bodies moderately heated, that is of a degree of heat inferior to red heat, do not radiate or give out any perceptible light with their heat, and therefore, these substances are separable. But why may not a portion of heat exist in the atmosphere immediately adjacent to the moderately heated body without being visible, as well as it may exist in far greater abundance in the body without being visible, since in both places it is easily made visible on being a little increased? Cannot even large quantities of that, far grosser, visible fluid, water, exist in the air, as well as in other bodies in an invisible state? and why not heat then? When, also, we observe all the variations of light from the brightness of mid-day to pitchy darkness, can we say, that none of the matter of light can exist in the air in an invisible state, or deny, that there is great probability from analogy, that it can?

So weak and inconclusive is the reasoning, on which is founded the unwarrantable conclusion, that heat and light are two, distinct elements, in opposition to the plainest testimony; while at the same time, suppositions altogether imaginary and farfetched have been necessarily made to account for the heat, which attends light. It is said, that calorific or heating rays are intermingled with the luminous rays of light, as if the same, simple substance could not possess the property of heating as well as shining. Can no simple substance possess more than one property?

From considerations like these I have adduced, I think it not unreasonable to assert, that fire is a simple substance, made up of light and heat. Indeed, whatever difficulty may have prevailed among physiologists in their endeavours after a right idea of fire, mankind in general have little misunderstanding respecting it. There is not, perhaps, a clearer idea in their minds. They always speak of it, and regard it as a material substance. They do not, indeed, suppose, that every thing they call fire is wholly so, or pure fire, as it is generally

intermixed with smoke and charcoal; yet that is called fire, wherein there is more of this substance than any other, that is, where fire greatly predominates, as in flame and red-hot bodies.

Nor is it difficult to discover what pure fire is, or fire existing separately from other matter, with which it is generally mingled; though it may be impossible for man to find it perfectly separated from all other matter. The same may be said, however, of every other element; all are more or less combined with the imponderable agents, and if wholly separated from them, would probably appear of a very different consistency from what they now do. Yet fire, being the most striking, distinct, masterly, and independent of all other substances, may be exhibited in its real, peculiar nature more clearly than any other matter, since there is none which can commend itself to our perceptions of vision and feeling in so overpowering a manner. The purer the fire is, the brighter and whiter is its colour, as we perceive on comparing it in flame and in coals. In flame, it is brighter and whiter than in coals, and the purer the flame, the whiter its colour. The white heat of bodies results also from the same predominancy, whereby the true colour of the matter of heat is developed, and its identity with that of fire clearly shown. Pure fire is white, as is shown in an inferior degree in the flame of a candle. The greatest heat also, as that of platinum, is white.

But the common fire of flame is very dim, when compared with that, which is developed by the chemist, as in the combustion of phosphorus and other substances in oxygen gas and by means of voltaic electricity, where fire appears of a refulgence, splendour, and whiteness, too great for human eyes to endure, and probably exhibits as sublime and celestial a spectacle, as man often beholds. Electric fire, passing between two metallic plates in a vacuum, is of a similar nature and perhaps perfectly separated from other matter. The superior

brightness and beauty of fire in these instances is evidently owing to its particular abundance and separation from other matter, which commonly obscures it; and its extreme resemblance in these cases to the appearance of light reflected from a mirror, the focus of a burning glass, the sun, and fixed stars, can leave little doubt, when all circumstances are considered, of the identity of the principle, which produces all light.

Dr. Hook by way of objection to the ancient theory of fire, inquires, "who understands what they meant by fire or flame, whether the ordinary fire of wood, coals, &c. or an elementary fire, or a third kind, such as the mass of the sun and fixed stars, or neither of all these?" Whatever 'they meant,' it is certain, that we have no right to say, that fire consists of different kinds, when it always assumes the same appearance under similar circumstances of intensity. There is apparently no greater difference between common fire and that of the sun, than there is between the fire of a candle burning in common air, and when burning in oxygen gas. It only exists in different degrees or quantities more or less obscured, as it departs from a refulgent whiteness of colour. Fire is an extremely hot, white, subtile, resplendent, simple substance, which penetrates, and pervades in a greater or less degree, all other bodies.

ON LIGHT.

"ANAXIMANDER, Anaxagoras, Leucippus, Heraclitus, Empedocles, Zeno and the stoics, Plato and his followers," says Hook, (Posthumous Works, p. 72,) "all make light to be fire or a flame issuing from a lucid body, as the sun, which they suppose the fountain of light, and to be all fire, flame, or pure light.—Anaxagoras called it 'a fiery mass'—'most pure fire'—'a vast mass of fire.' And wheresoever there was light, there they suppose fire, and that it produced the effects of fire, where it was dense enough, but if it were not dense, it only made things visible, and produced the effect, that we call light." Hook then makes this objection. "Who can imagine, that the body of flame, which appears at one instant in the top of a candle, should at the same instant fill a hemisphere of the atmosphere, ten, twenty, or more miles in diameter; and yet it must be concluded so to do if this be the cause of light." But, indeed, is it more impossible to conceive of the vast expansion of fire in the form of light, than to conceive of the minuteness of the particles of light, its swiftness, or any other of the qualities of any of the imponderable agents? Yet how could he say, 'fill' such a hemisphere, when only a few faint rays of a candle can traverse the distance he mentions? And how could he say that the small flame of the candle composed at the same instant all the light, which was about it? Is there not a constant egression of fire from the oil of a lamp into the flame during the decomposition of the oil? and is there not the same, constant emission of fire from the flame into the air, where it takes the form of light? The light, then, afforded by a lamp arises merely

from a continual emission of fire from the oil, where it was before latent. There is much more light, then, in that hemisphere than exists at any one instant in the flame of the candle.

And so it is with all light. It always consists of fire sent forth from a luminous body, and is more or less intense as it is more or less expanded and unobscured. What proves this position with the utmost clearness, is, that the light, which has proceeded from the state of flame or fire, may be easily condensed into fire again by means of a burning-glass. Will not a large burning glass collect the rays, that come from the sun's fire, and condense them into the hottest and most resplendent fire again, which entirely resembles the sun's fire? Will not the same glass reverse the light, which has flowed from a common fire into fire again? Does not this focus represent more or less intense fire, as the light, which composes it, is more or less intense? Will not a large burning-glass condense light into the purest and hottest fire? "The greatest degree of heat producible by man," says Macquer in his Chymistry, "is that excited by the rays of the sun, collected in the focus of a large burning-glass." It is needless to dwell on this point; the evidence is the clearest and strongest imaginable; how idle then are those vagaries about the composition of light, which have distracted so many brains, in departing from the simple theories of antiquity.

Can light pierce denser substances than fire will? Can it march with more rapidity than the lightning of the clouds or the fire of electricity? We need not any tardy processes of induction or scholastic analysis to teach us these truths; they are sufficiently clear without them. But it may be said, there are some species of light, as moonlight and phosphorescent light, which are void of all heat, and how can that be, if their substance consists of expanded fire? There may be many kinds of faint light, such as become visible only in the dark, which may discover no heat appreciable by the most delicate ther-

mometer, and yet it would be wrong to say, that they contain no caloric. A thermometer is surely a no more delicate instrument than a balance, and moonlight may be no colder than fire-light, than hydrogen is lighter than lead, and yet possess caloric. Caloric pervades all bodies, and of course the phosphorescent among others. Indeed, what is called 'solar phosphori,' becomes luminous in the dark after being exposed to the sun's rays, and other substances are rendered luminous on being scattered in a coarse powder upon a heated iron plate, which plainly shows the connexion of caloric with this sort of light as well as with all light. Many insects afford phosphorescent light, but we can suppose none of them destitute of some quantity of animal heat, and it is a curious circumstance, that some of these insects become more luminous, when they are irritated, which must be the result of increased animal heat, as we know, that it is the nature even of human bodies to become warmed by passion.

Indeed, the connexion of the matter of caloric with light is universal, and it is well known, that their respective properties are extremely similar. Caloric does not produce vision, because it exists in opaque instead of transparent mediums. Light decomposes certain substances, decomposition being a universal effect of heat and fire; but it is said, that light produces some "chemical changes, which do not arise from the operation of caloric." Now this is certain, that there are no substances independent of the imponderable agents, which fire and heat will not decompose. The changes, that are wrought on matter by light and heat, are almost infinite. If among these some minute or inconsiderable ones have been observed to be affected by certain portions of light, which have not been observed to be affected by heat, it is owing probably to the different quantity or manner, in which the matter of light and caloric is applied. Light is also of the white colour of fire, and when reflected in the sun beams falling on polished sur-

faces, more particularly on a mirror, it exhibits a splendor altogether similar to that of pure fire. Numerous other instances of the resemblance of the matter of light to that of fire and heat might be urged if necessary.

ON HEAT.

The matter of fire, then, proceeding originally from the sun, falls in rays upon the atmosphere of the earth, and penetrates all terrestrial substances on account of the extreme subtility of its particles, diffusing itself into every part of them, and existing in them in greater or less quantities according to their density or quantity of matter. In transparent bodies, as the atmosphere, the matter of fire exists in the form of light, but in opaque matter, as earth, it is latent, and assumes the name of heat or caloric. When it abounds, however, in opaque matter, its tendency is to become visible and render even this sort of matter somewhat transparent, as when any dense substance is heated to a red or white heat. Transparent matter is rendered more or less transparent and lucid according to the quantity of light there is in it, for it is the nature of fire to penetrate and enlighten all matter.

But does the element of caloric indeed consist of no other substance but that of elementary fire? The matter of fire and light being identical, little doubt can remain of the consistency of heat. If it is merely expanded, elementary fire, which constitutes light in transparent matter, it must be the same, which forms caloric in opaque. The element of fire becomes visible in the one on account of that consistency of particles, which renders it susceptible of transparency, and invisible in the other on account of that opposite nature and consistency of particles, which gives it the quality of opacity. It is, indeed, certain, that fire does exist in opaque matter as well as in transparent, and even in greater quantities according

to its superior density, from the circumstance, that sparks of fire can be easily elicited from it; as for instance, from flint and steel by concussion. Violent friction and percussion will drive out fire from all the denser sort of bodies.

There is, in fact, a certain substance, which from its peculiar nature, when heated, cannot conceal its caloric from vision, but shows openly and plainly of what sort of matter this element consists. This certain substance is smoke. Smoke intensely heated becomes flame, "for," says Newton in his Optics, "what is flame but red-hot smoke? 'Tis certain that flame is only the volatile part of the fuel, heated red-hot, that is, so hot as to shine." Is not this a complete disclosure of the mysterious consistency of caloric? And that it is composed of common fire only? No one will deny that fire is developed in smoke heated shining hot. How identical then is the matter of heat and fire.

To show in another way, that it is the matter of fire only which penetrates heated matter, and there constitute caloric, we can make this simple experiment. Hold a piece of wire gauze in the flame of a candle. The flame will not pass up through the meshes of the gauze, but its smoke will, leaving the flame to all appearance cut off, where it touches the gauze, so rapidly does the metal absorb it, and transform it into heat, for the gauze becomes immediately very hot. And it is the pure fire only of the flame, which enters into the metal, and constitutes its heat, since all the vapour of the flame passes through the meshes.

But we have not only palpable evidence in innumerable instances of fire entering directly into matter and then constituting heat, but also of its bursting out again into the form of fire. It is well known, that all of the most combustible substances on being heated to a certain degree are suddenly decomposed by the evolution of their caloric, with which they become surcharged, into flame. How quickly is the increased

caloric of fulminating powder sent forth into vivid flame, rending its former prison-house into tatters. Decomposition which is the universal effect of fire is also the general effect of intense heat. Indeed, can any one say with propriety that this sort of matter is unknown? Can it be any thing else than pure elementary fire in a latent state? A kind of matter, which I think I may say is better known to all mankind than any other, for is it not the use of fire, and consequently a knowledge of the same, which constitutes one remarkable distinction of men above brutes? A full knowledge of this element, however, comprising all its extensive powers, is in the present state of philosophy in the possession of few.

ON ELECTRICITY.

HEAT, in the general sense of the term, means that quantity of elementary fire, which produces a sensation of warmth in our bodies. If the temperature of matter is below that of our bodies, it discovers no sensation of warmth to our feeling, however much elementary fire it may really contain. Thus, if the hand is laid on a piece of iron or a piece of stone, heat passes out of the hand into those substances, and produces the sensation of cold, because they are not so fully charged with the matter of heat as the hand; but although the iron or stone feels cold, it is really impregnated with the matter of fire, since fire may be easily struck out of either of them in sparks by concussion. So all matter contains the substance of fire diffused through it, although it be not always perceptible to the touch. This latent imperceptible degree of elementary fire, which dwells in all bodies in equilibrated quantities, constitutes the matter of electricity. This is certain, since whenever any high degree of electricity is developed, it always appears in sparks and fire. Abundance of fiery sparks are thrown off by electrical machines, and oftentimes flashes of pure fire.

Yet so unwilling are electricians of modern date to concede to this plainest dictate of sense, that they will not allow this fire to be the electricity itself, but say, that it is occasioned by the compression or friction of an invisible fluid against the atmosphere which resists its progress; while the same fluid may pass throught the *densest metal* without discovering any such effects of friction. The matter of light in the sun's hottest rays may pass through many miles of atmosphere con-

tinually, with the utmost rapidity, without exciting any sparks or any fire at all by friction. Is the electric fluid any more subtile, swift, or abundant than the matter of light? And is it possible for any one fluid to pass through another, especially so yielding a one as air, in such a manner as to excite a flash of fire by friction? If it were, would not the universe be soon set on fire by the continual flights of the matter of caloric and light through every part of it?

But remove this mighty cause of friction, the atmosphere, and suffer the electric fluid to travel through a vacuum, and see if the same quantity of fire is not then developed.

'Watson,' says Priestley, (History of Electricity.) 'exhausted a glass cylinder three feet in length and three inches in diameter with a contrivance to let down a brass plate as far as he pleased into it, in order to make it approach another plate fixed near the bottom of the vessel.' This cylinder thus prepared he insulated, and observed, that when the upper plate was electrified, the electric matter would pass from one plate to another at the greatest distance to which the brass plate could be drawn. 'It was a most delightful spectacle,' he says, 'when the room was darkened, to see the electric matter in its passage through this vacuum; to observe, not as in the open air, small brushes or pencils of rays an inch or two in length,' (from the tendency of the air to absorb it,) 'but corruscations of the whole length of the tube and of a bright, silver hue.' (Being pure fire unobscured by the grosser particles of other matter.) 'Sometimes he observed, that when the tube had been exhausted in the most perfect manner, the electric fluid was seen to pass between the brass plates in one continued stream of the same dimensions throughout the whole length. He made this vacuum part of a circuit necessary to make the discharge of a phial, and at the instant of the explosion, there was seen a *mass of bright embodied fire*, jumping from one of the brass plates in the tube to the

other.—To find a more perfect vacuum for the passage of the electric fluid, he had recourse to an excellent invention of Lord Charles Cavendish, who by means of a long bent tube of glass, filled with mercury and inverted, made all the bended part of it, which was above the mercury, the most perfect vacuum, that can be made by man. This vacuum Dr. Watson insulated, and one of the basons of mercury being made to communicate with the conductor, when some non-electric substance touched the other, the electric matter pervaded the vacuum in a continued *arch of lambent flame*, and as far as the eye could follow it without the least divergency.'

By such experiments, we have not only the strongest evidence of the identity of the electric fluid and elementary fire, but a fair exhibition of the substance of fire, separated from other matter, and shown in its native purity with the utmost certainty of its being a material, simple, resplendent element; and not only so, but the most real, sublime, and wonderful of all the elements of matter. Whatever be the surprising properties belonging to electricity, they must be in truth those only of elementary fire, and form an addition to our knowledge of it above what was possessed by antiquity. 'Indeed, in the early stages of the science of electricity,' says Priestley, 'it was generally supposed, that the matter of the electric fluid was the same as the chemical principle, fire, though some thought that it was a peculiar fluid, which very much resembled that of fire.'

If we regard the primary and simplest development of this principle, we find all circumstances concurring to unriddle its nature and consistency. The friction of a resinous or vitreous substance by a woollen cloth produces the first or slightest phenomena of electricity. Now it is well known, that heat is the general effect of friction, and it is further evident, that it is a slight, sudden degree of heat only, thus excited on the surface of the glass or resin, which produces the electrical

phenomena, from the fact, that the glass slightly heated by a fire will have precisely the same effect. It is necessary, however, to pass a woollen cloth over the glass, after it is heated, in order to remove the soil, that becomes attached to it from exposure to fire, and which would otherwise absorb the electricity. Indeed, it is a common practice with electricians to warm the glass tube by a fire, that less friction may be necessary to develop the phenomenon. As greater quantities of this matter were excited in the prosecution of its discovery, it was observed to give a faint light in the dark, as strongly electrified bodies always will; and Hauksbee discovered, that it would render some substances, as sealing-wax, transparent; properties, common to light. Also, when the tendency of electricity to preserve an equilibrium was discovered, the evidence became still stronger of the identity of its matter with that of light and caloric, whose universal pervasion of nature was long before known, and to whose mysterious powers no limits could be set, which might forbid them to produce the effects now discovered. Light had always been observed to hold a universal equilibrium in atmospheric matter, and to be as little inclined to admit a vacuum of its presence there, as the waters of the sea are within the limits of their compass, darting at dawn of morning into every nook of the meanest habitation, and rolling its tide with the advance of day over seas and continents. No density of substance being able to resist its penetration, and all bodies containing more or less of its substance according to their quantity of matter, how easy it is to account for electric appearances. Glass and resin discover this fluid more readily than other substances, because they are the worst of all conductors of the matter of heat, which, on this account, when suddenly excited on their surfaces, escapes outwardly, or where it finds least resistance to its diffusion, and thus discovers the electric attraction and repulsion.

To trace still further the circumstances which develop the real identity of electric and elementary fire, since many electricians are so averse to recognise it, let us consider some of W. Jones' arguments on this subject. (Prin. of Nat. Phi. p. 134.)

1. 'We call that elementary fire,' says he, 'which lights a candle, kindles spirits, and fires gunpowder. The electrical ether,' (fire he should have said,) 'will do all these, and if it be different from elementary fire, then we have two material causes in nature intended to produce the same effects, when either of these alone would have been sufficient.

2. 'If the electrical fire will have the effects of the elementary, it is equally true, that the elementary will have the effects of the electrical. The rays of the sun will put amber and resin into an attracting and repelling state, the solar fluid being put into motion within the pores of these bodies, produces the same effects with the electrical, and in some particular instances, a culinary fire will do the like, though neither of them in any very considerable degree.

3. 'The light emitted by the attrition of a glass globe, and more especially the spark of an electrical explosion may be divided by viewing it through a prism into the seven primordial colours, like the element that flows from the sun or the light emitted by a common fire. When the solar light passes through a leaf of gold held up between the eye and a window, only the green-making rays are transmitted; and it is remarkable, that the electrical spark, which issues from a body covered with leaf-gold, is of the same colour, though something more dilute.

'Upon the whole,' continues he, 'if these fluids, which thus mutually, and in all respects assume each others offices and properties, are not the same, experiment is a thing not to be relied on, and the most obvious rules of philosophizing, adopted and approved by all parties, are no better than specious deceptions. That the electrical fluid is the same as

that, which is sent from the sun in the form of light, and gives heat to the atmosphere, is still farther evident from the production of lightning. After a serene day in summer, when the air has been exceedingly heated, we are generally sure to be visited with thunder and lightning, in which case, the matter discharged from the air in the form of lightning, is undoubtedly the same as the matter accumulated, and from which the excess of heat proceeded. But the matter of lightning and that of the electrical explosion are now allowed on all hands to be the same. The elementary, solar, and electrical fire, then, as we have every possible reason to conclude, are but one substance acting in several capacities.'

Franklin, also, who did so much to advance this science, writes, (Let. & Obs. on Phi. Sub.) "How many ways there are of kindling fire or producing heat in bodies! By the sun's rays, by collision, by friction, by hammering, by putrefaction, by fermentation, by mixtures of fluids, by mixtures of solids with fluids, and by electricity. Does not this seem to indicate, that the fire existed in the body, though in a quiescent state, before it was, by any of these means, excited, disengaged, and brought forth to action and to view? May it not constitute part, and even a principal part of the solid substances of bodies? If this should be the case, kindling fire in a body would be nothing more than developing this inflammable principle.—Common fire is in all bodies more or less as well as electrical fire. Perhaps they may be different modifications of the same element.—If they are different things, yet they may and do subsist together in the same body. When electrical fire strikes through a body, it acts upon the common fire contained in it, and puts that fire in motion, and if there be a sufficient quantity of each kind of fire, the body will be inflamed. When the quantity of common fire in the body is small, the quanity of electrical fire should be greater; if the quantity of common fire be great, less electrical fire

suffices to produce the effect. Thus spirits must be heated before we fire them by the electric spark. If they be much heated, a small spark will do, if not, the spark must be greater. Till lately, we could only fire warm vapours, but when we can procure greater electrical sparks, we may be able to fire not only unwarmed spirits, as lightning does, but even wood, by giving sufficient agitation to the common fire contained in it, as friction we know will do."

And so wood can be fired now by the electricity of the Voltaic apparatus, where, instead of sparks, streams of fire are elicited, and charcoal is burned with the utmost splendour. New properties of this element have been discovered by this recent invention, which confirm still more strongly its identity with fire. It is well known that decomposition is the common effect of the electricity thus developed, and it is equally well known, that decomposition is the universal effect of heat and fire. And not only wood may be decomposed by this electricity, but even iron. The two poles of the electric pile called the Calorimotor, being connected by a large wire, the wire may be quickly melted by the passage of the electricity through it.

Caloric and electric matter being the same, there are numerous cases of the development of electricity by common heat. Melted sulphur, for instance, being poured into an insulated metallic vessel, is found on cooling to be positively electrified, and the vessel negatively, owing to the sudden contact of two such bodies of so different temperatures. Also gum-lac, amber, rosin, baked wood, and such like, are capable of being electrified by common heat. Certain crystallized minerals also of a vitreous nature, become electrical when heated to a certain degree, as a glass tube will. The reason, that heat and fire in general no oftener display these phenomena, is owing to the different circumstances attending them, from those of electrical excitation. They are not so suddenly

excited, nor in the insulated manner of an electrical machine. They are often enveloped also by smoke and vapour, which absorb and dispel the electrical tendency of a sudden excitation of heat. There is a certain, native quantity of elementary fire existing in all bodies, which is absolutely necessary for their preservation and consistency, and, therefore, whenever disturbed, it rushes quickly back to restore its equilibrium. On the other hand, excessive heat appears to be a sort of superfluity of the former, whose office it is to dissolve rather than unite bodies, and these opposite effects of the same substance are no more irreconcilable than the extremely similar effects of electric attraction and repulsion. Other arguments arise from the circumstance, that those substances, which are good or bad conductors of electricity, are the same with respect to heat. Water and the metals absorb both with equal readiness; the latter transmit both with equal facility, while vitreous and resinous bodies resist the penetration of each with like success. Window-glass is so thin as not to be able to forbid the entrance of common light, as thin glass also will but slightly resist the impression of electricity. Intensely heated matter emits sparks, so does strongly electrified matter. Electricity pervades the surfaces of bodies, and so does heat, it being well known, for instance, that provisions, baking or roasting, have their superficial parts first affected by heat; indeed, if a piece of provision a baking be examined when it is half baked, will not the superficial parts be sufficiently done, while the inside remains unaffected? And so it is in all kinds of cookery, and where external heat is applied to bodies; in like manner as electricity disposes itself upon surfaces.

The identity of the electric and elementary fire being certain, that theory, which divides it into two distinct kinds, the vitreous and the resinous, must be wholly imaginary. The theory of positive and negative, by which we understand plus

and minus quantities of the same fluid, has not only prevailed to greater extent, but is by far the more reasonable. Even Du Fay himself, the author of the former theory, is said to have "dropped it at last, and thought, that all the phenomena might be accounted for from the action of a single fluid."

Finally, it seems to be doing very little merely to allow, that the electric substance is single and elementary, when its phenomena so plainly confirm the ancient doctrine of fire. It seems to be much more becoming the spirit of experimental philosophy and modern investigation to seize on the numerous phenomena exhibited by electrical experiments for extending on the most certain grounds the knowledge of the ancients respecting the element of the sun, even to a full developement of all the secondary causes of physical appearances, and consequently, of those among the rest, which were before inexplicable. "By the vulgar, indeed, the matter has long ago been determined, and the rays of the sun as well as the electrical fluid have been promiscuonsly denominated elementary fire. Philosophers have withheld their assent, though the reasons for so doing are by no means apparent. The most strange suppositions, however, have been made concerning the nature of both those fluids, and on the most slender grounds imaginable, or rather on no grounds at all.—Under the article, Electricity, we have endeavoured to show, that the electric matter is no other than the light of the sun, absorbed by the earth, and thus becoming subject to new laws and assuming many properties apparently different from what it has, when it acts as light. Even in this case, it manifests its identity with fire or light, viz. by producing a most intense heat, when a large quantity of it passes through a small space. —At any rate, the experiments which have already been made, and the proofs adduced from the phenomena of nature show such a strong affinity between the elements of fire, light, and electricity, that we may not only assert their identity upon

the most probable grounds, but lay it down as a position, against which no argument of any weight has an existence at present." (Encyclopedia, Dobson's.)

One circumstance often dwelt on, for showing that the electric fire is occasioned by the friction of an invisible fluid against the atmosphere, is, that an electric spark being let loose in vacuo, the light it gives is fainter than in the open air; but this is owing entirely to a greater diffusion of the light through the extremely rare vapour in vacuo. In proof of which, "we have only to introduce two pointed wires into the vacuum, so that the fluid may pass from the point of the one to the point of the other, and when the distance between them is not more than the tenth of an inch, and in this case, we shall find the spark as bright as in the open air." (Ib.)

ON MAGNETISM.

Our next object is to show, that the magnetic fluid is only a modification of the electric, and consists merely of latent elementary fire. Magnetism is evidently a sort of natural or spontaneous electricity, not so easily dissipated as the latter, because it is not excited by any so sudden or artificial means, and consequently, never discovers sparks, nor any of the latent fire of which it consists. It prevails in the densest and heaviest substances, as loadstone, which always have the greatest capacity for fire, and of course, contain most of it in a natural state. Thus, it appears to be owing merely to the natural capacity of loadstone for elementary fire, that it possesses this property. It was once thought, that this property was confined to the loadstone and iron, but it has since been ascertained that magnetism, like electricity, dwells in all bodies, but in greater or less quantities, according to their natural capacities for elementary fire. The whole earth is called a magnet. Needles formed of any substance whatever are found to possess a degree of magnetism, or can be rendered magnetic on being suspended between two powerful magnets, as it was discovered by Coulomb in 1812. (Biot's Traité de Physique.)

To prove the identity of the electric and magnetic fluid, we may trace the following resemblances.

1. A magnet, like an electric or electrified substance, attracts small bodies at a distance, iron filings more especially, yet all other bodies under particular circumstances, as stated above.

2. Electricity is positive or negative, each of which repels its own kind, and attracts the opposite. In magnets, the north and south poles, or boreal and austral kinds of magnetism, as they are called, do the same, each repelling its own kind or degree, and attracting the opposite.

3. When one body is electrified by another, it receives an opposite degree of electricity, and is attracted; so also when iron or steel is magnetized, it receives an opposite degree of magnetism from that of the magnet it derives it from. One degree of electricity is always attended by the other, or cannot be produced without the other, "neither is it possible to produce one degree of magnetism without the other also."

4. Some substances, as amber and glass, retain electricity longer than others; so cast iron, steel, nickel, and cobalt, retain magnetism longer than other substances will, except loadstone. Electricity pervades and leaves most substances quickly, as magnetism often does; for even iron and nickel, when "pure and perfectly ductile, do not retain their magnetism, but acquire and lose it instantaneously." Indeed, soft iron is a conductor of magnetism, as it is also of electricity, for if we "append a piece of iron of considerable length to one of the poles of a magnet, the end farthest from the magnet will also attract iron with much more force than the magnet could do at that distance without it, while at the same time, this attractive power is plainly that of the magnet itself, and not in any way inherent in the iron, as it vanishes the moment we separate them."

5. Electricity is most powerful on points, which are found to carry it off or receive it in great quantities. In like manner, a magnet will hold a piece of iron more powerfully by a corner or blunt point than by a flat surface.

6. "As a rod of iron," says Æpinus, "held near a magnet will have successive poles, so will a glass tube touched by an excited tube, have a succession of positive and negative parts.

Glass is a substance of a nature similar to hardened steel. The positive and negative sides of the former answer to the attracting and repelling ends of the latter when magnetical.

7. "An electrified body does not act upon other bodies, except they are themselves electrified, just as a magnet will not act on other substances, except they are themselves possessed of the magnetic virtue."

8. Another physiologist observes, "that if the tourmaline be cut into several pieces, each piece will have a positive and negative side, just as the pieces of a broken magnet would have.—The two magnetisms reside in the opposite poles of a loadstone in the same manner as the two electrics reside in the opposite poles of a heated tourmaline."

9. The magnetical phenomena have a striking resemblance not only to those of the tourmaline, but also to those of an insulated, electric pile. Indeed, if a magnetic bar be broken into any number of pieces, each of these pieces exhibits two poles exactly like those not only of an entire, electrical pile, but of any of the elements or parts of this pile.

10. Common heat often produces electrical effects, and so it does magnetical. "The effects produced on impolarized iron are directly the reverse of those produced on a magnet, an increase of temperature causing an increase in the magnetic power of the iron." (Phil. Trans. 1824.) Indeed, what is most obvious, bars of steel may be magnetized by fire alone merely by heating them suddenly and then cooling them in cold water. Magnetism is excited also "by different mechanical means, as by the blow of a hammer, by pressure, and by torsion," means which always excite heat. "The utensils used by locksmiths almost always become magnetic by the repeated blows to which they are subjected. Scissors, knives, and almost all cutting instruments are more or less so; particularly, if they have been employed in cutting iron." Iron crosses of church-spires also, and other bars of this metal acquire magnetism by long exposure to the air and solar rays.

11. Intense heat destroys electrical properties, and so it does magnetical. "From 3° of Fahrenheit and even much lower, up to 127°, the intensity of magnets decreases, as the temperature increases.—Beyond the temperature of 100°, a portion of the power of the magnet is permanently destroyed. —A magnetic bar of whatever metal loses it virtue, when it is brought to a white heat."

12. Magnetism is not only impressed by heat but by electricity itself; and does not this establish the truth as strongly, as experiment can do it, that it is elementary fire alone which constitutes the matter of magnetism? "By Electricity," says Franklin, "we have frequently given polarity to needles, and reversed it at pleasure. A shock from four large glass jars, sent through a fine sewing needle, gives it polarity, and it will traverse when laid on water." Priestley also observes, that "One of the most remarkable effects of lightning is its giving polarity to the magnetic needle and to all bodies, that have any thing of iron in them, as bricks &c., and by observing which way the poles of these bodies lie, it may be known with the utmost certainty in what direction the stroke passed." M. Oersted, professor of chemistry at Copenhagen, discovered, that the electric current of the voltaic apparatus will impart magnetism to any metallic body. The magnetism thus imparted may not be so permanent as that afforded by loadstones, because the circumstances of the process are so different, and will not give the element time or opportunity to insinuate itself in such quantities and so thoroughly into the magnetized body as by the continued contact of loadstones.

13. The matter of light also produces magnetism, as it was discovered by Dr. Morichini of Rome. A needle on being exposed for a certain time to the violet-making rays of a prism, acquires magnetic properties. (Edinburgh Journal of Science, 1826.)

Hence, there is not only the most distinct resemblance between all the principal phenomena of electricity and magnetism, the effects of the former being more powerful merely in proportion to the more extraordinary means, which are used to excite it, but electricity, heat, and light, each of them distinctly, separately, and solely, produces magnetism. Could we wish for completer proofs of the identity of its matter with that of elementary fire? Consequently, whatever objections may be offered to this theory may be easily obviated. Let us study to produce one.

"The electric virtue resides on the surface, but that of the magnet pervades the whole substance," (of natural magnets,) "and a magnet," (of this kind,) "loses nothing of its power by communicating its virtue to other bodies, but electricity always does, being exceedingly perishable, while the magnetic virtue is permanent." All this is owing to the peculiar consistency and density of the natural magnet, whereby it has by nature such a capacity for elementary fire as by nature to contain a superior and sufficient degree of it for producing electrical or magnetical effects. Electrics, on the other hand, are of much grosser consistency and less capacity for fire; therefore, when it is impressed upon them by artificial, sudden, or violent means, it only pervades them superficially, and is dissipated as rapidly as it is collected. Take a stick of sealing-wax and a piece of loadstone. The sealing-wax, from its lighter and grosser consistency, does not contain so much elementary fire as the loadstone, but must receive an additional quantity by friction, before it becomes attractive, and as this additional quantity is impressed upon its surface, it discovers a quicker power of attraction than the magnet does. Indeed, the motions of electricity are more impetuous and quick than those of magnetism, owing to its particular abundance and the particular means, which are used in exciting it. Common artificial magnets also, being of a consistency akin to that of the na-

magnet, retain their properties with a degree of permanence, but as they are artificially acquired, they eventually decay. Magnetism is a sort of natural, quiescent, spontaneous electricity, discovering no violent effects, because no extraordinary means are used in its production, and because it resides in the densest bodies.

Finally, such appears to be the unity of the element which constitutes the imponderable agents. In the atmosphere and other transparent matter, it appears under the form of light. In opaque matter, it constitutes heat, electricity, and magnetism; heat when it abounds so much as to produce the sensation of warmth; electricity, when its universal equilibrium is disturbed by certain artificial means; magnetism, where it naturally exists in peculiar abundance in certain bodies, which have the greatest capacity for it. Thus, all these terms should signify merely different states of the same great, primary element, which has its source in the sun, from which it is constantly proceeding. Whenever it is condensed, or overcomes, or is developed from the grosser, opaque matter, which obscures it, then it assumes the form of fire, more or less splendid and pure, however, according as it is condensed and unobscured by the matter in which it appears. Then, we have an opportunity of seeing with our eyes and examining the curious substance, which is constantly working such wonders in a hidden state.

Is not this the truth? Have we not an ample sufficiency of experiments and observations to confirm it according to the strictest philosophy? Do we not violence to the plainest dictates of nature and reason by rejecting it? No one, I presume, who examines this subject with only a moderate degree of attention and impartiality can remain of a dubious opinion respecting it. What then are we to think of those opinions, which have been so long noised abroad about the immateriality of heat and light, the two electricities and two magnetisms,

the separation of heat and light, and the distinct specification of half a dozen elements utterly unknown and inexplcable? Does every stone which we pick up from the ground contain within it three or four distinct, mysterious, imponderable elements, which have never been seen by the human eye? Is not this making a bungling piece of workmanship of the material world by a needless and imaginary multiplication of second causes? Is it not leading to the darkest scepticism? Can these opinions be perpetual? Are they not destined to be reckoned erelong among the dreams of the alchymists and the quiddities of the schoolmen? Have they not already sufficiently bewildered the human intellect?

ON THE SUN.

Let us now raise our thoughts a little to a contemplation of the great fountain of light and fire, for a certain circumstance is pressing upon us, which is in much need of an explication. It is this. How is the sun supplied with fire, as he is continually sending it forth in floods and torrents to vivify the planets that move about him? Does any of his light return to him? Is it not for the most part absorbed by the opaque bodies it falls on? How can it be then, that he should not have become greatly diminished, if he has been sending forth light in such prodigious quantities, and with such extreme velocity as is ascribed to it, ever since the creation? Some attempts have been made to solve this difficulty, but not to entire satisfaction.

It was the opinion of Herschel, that the sun might not be a globe of fire, and so also of Newton. Herschel fancied that it might be a beautiful, habitable world, surrounded by very luminous matter or clouds floating in its atmosphere, and that the sun's spots were occasioned by intermissions of these clouds, which discover the dark body of the sun. This and such like hypotheses must be works of imagination only, for the sun has every appearance of a vast, pure, intense fire, not only to the naked eye but also as seen through the best telescopes; for then his disk displays all the splendour, effervescence, and ebullition, that can be supposed to attend so vast a fire; insomuch that after every caution taken in viewing his spots, it is accompanied with much danger to the eyes. We cannot suppose all this splendour to attend any possible kind

of atmosphere enveloping an opaque body. Is it possible from the nature of the light which we receive from him, and which we are obliged to make such constant provision of fuel in order to support in our common candles, that it could proceed from an atmosphere or subsist in any kind of a one? No; the sun must be a very huge fire, as we have every reason from analogy to suppose by the light and heat which he affords us, and, consequently, he must have an immense stock of fuel to feed on, as we may judge from the fuel, which even a little lamp requires for its support.

And have we not strong intimations for believing in the existence of such fuel in the sun from those black spots, which appear so frequently upon his disk, and are sometimes visible to the naked eye? Are not these spots encircled by an edge of "particular brightness?" Do they not diminish daily in size, until before a great while, they totally disappear? And then, are not the places where they were brighter than other parts of the sun's disk? Has not warmer weather been known to follow them? Do not all these circumstances afford strong grounds for concluding, that these spots are parts or corners or apexes of masses of the sun's fuel consuming gradually? But how does the sun obtain such masses of fuel? This is another question. Yet are there never seen any kind of planetary bodies going near the sun, which, by falling to him themselves or flinging him some part of their own bodies, may be supposed to afford this supply? There are; a numerous and singular class of planetary bodies, whose phenomena and motions favour this hypothesis, and whose uses cannot be easily accounted for on other suppositions, for it is impossible for them to be inhabited by any beings we can conceive of, on account of the vast extremes of heat and cold to which they would be exposed. Comets are of this curious description, whose wild, unaecountable appearances once struck nations with terror. These mysterious and numerous bodies are seen racing across the heavens in every direction.

What renders it probable, that comets are appointed to afford or carry the sun fuel in some way or other, is, that they revolve in extremely elliptical orbits, and pass very near to the sun in one part of them, the other part extending indefinitely into space far beyond the ken of the best telescopes. In these remote parts of the heavens, it is possible, that they obtain loads of fuel. There may be many small planetary bodies or masses of matter in these remote regions for aught we know, which being under an inferior influence of the sun's attraction on account of their distance from him, may be easily affected by the attraction of a comet coming among them. The comet in approaching one of these bodies may include it within its sphere of attraction, and draw it down upon its own body; then its own gravity towards the sun would be increased, which would impel the comet towards him in an elliptical direction. When the comet approaches the sun, the superior attraction of this luminary may pull away the little planet from the comet to himself for fuel, the planet not being so strongly attached to the perhaps different or denser body of the comet as to forbid its separation, which might take place at a nearer or greater distance from the sun according to the ease with which the planetary matter may be separated from the comet. The comet being thus rid of its load must be driven away again in an elliptical direction by the sun's electricity, having lost that degree of gravity, occasioned by its load, which impelled it towards him. All the appearances of comets favour this hypothesis, or something like it, as their diverse and irregular shapes, not being always perfectly spherical like other planets, and their long tails, which probably consist of a sort of atmosphere, smoke, or exhalations of the comet, blown off by the repelling force of the sun's electricity, against which gravity is violently urging it, as these tails are always situated on the side of the comet farthest from the sun. They have been observed also to appear brighter, and I think larger, when

approaching than when leaving thesun, on account, perhaps, of their having left a part of their bodies with him. Perhaps those meteoric stones, which sometimes fall to the earth, come from some small bodies that revolve in the firmament, and are gathered by the comets and carried to the sun. The circumstance of comets traversing the heavens in all directions favours this idea. It may be, that some comets sometimes fall themselves upon the body of the sun. Newton observes, that "fixed stars, which fail by degrees in light and vapours, may be replenished by comets falling upon them, when being fired by new aliment, they may be reckoned as new stars. Of this kind are those stars that appear suddenly, and shine with great splendour at first, and then, by degrees, wear away." (Prin. Math. Phil.) Indeed, it is not an uncommon sight to see fixed stars changing from one magnitude to another. The idea, that comets abound in vapour, and that their use is to supply other planets with moisture seems to be an hypothesis founded on no solid reasons; for what reason have we for supposing, that evaporation is not sufficient for supplying the atmosphere with all its moisture? If water sometimes becomes concrete, does it not also become liquid again? If it did not, but was replenished by vapour of comets, the bulk of our earth must be increasing.

If the sun did not consist in part of some grosser matter than fire, which may serve for fuel, and over which his flames are spread, it would be impossible for him to preserve his spherical consistency, if it be a fact, that fire of itself has not a sufficient gravity or affinity of cohesion among its own particles for this purpose, as there is reason for supposing from its universal tendency to diffuse itself through all other matter. And if the sun was not a great fire but merely a kind of hot opaque body, we have no reason from analogy to conclude, that he would appear any different from the moon or planets, unless he were a little brighter or redder withal. His light would

would be steady and of a reflectent appearance like theirs, without any of that convolving, flashing, fiery motion so peculiar to him and the fixed stars, and indeed, in a less degree to all great and intense fires, which we behold on the earth.

Our planet probably reflects but little of the light off again which falls upon it, if we may so judge from the extreme faintness of the reflected light, which the moon sends to us, and since we observe a universal tendency of the terrestrial matter about us to absorb the matter of light, which we have little reason for supposing does not penetrate into every part of the earth. Must she not then be gradually acquiring heat? Must she not still retain within her the most of that light, which has been perpetually coming to her from the sun, ever since the creation? Must she not have been gradually increasing her stock of elementary fire ever since that time? It is a natural consequence. We have every reason for supposing it; and we thus come to account for a singular fact in natural science, which is inexplicable to satisfaction on other grounds. It is this, that various regions of the earth have been gradually growing warmer since the times of antiquity. 'It may be affirmed as an unquestionable fact, that the soil and temperature of all the lands from Spain to India, and from the ridge of Mount Atlas to Lapland and the remote parts of the north, have in the course of ages, since the period of the oldest historical monuments still extant, to the present time, been gradually subjected to a complete change from a state of much moisture and cold to a great degree of dryness and warmth. The effect has been constant and uniform, and must, therefore, be traced to a corresponding cause.' (Cyclopedia, Rees'.) 'The change of our climate,' says Williams, in his History of Vermont, 'instead of being so slow and gradual as to be a matter of doubt, is so rapid and constant, that it is the subject of common observation and experience. It has been observed in every part of the United States.'

Such changes being known to have taken place in so extensive districts of the eastern and western hemispheres, where alone historical monuments have been handed down for ascertaining the fact, is it not altogether probable that a similar change has taken place throughout the whole earth? Has not the change been going on ever since the sun began to shine? And is it not evidently owing to the increasing stock of elementary fire, which the earth has been gradually gaining from a perpetual absorption of the solar rays? Will not this stock still go on increasing from the permanency of the cause, until the final consummation of all things, when that great traditional and prophesied conflagration shall take place by the developement of elementary fire, and "the heavens shall pass away with a great noise, and the elements shall melt with a fervent heat, the earth also and the works, that are therein, shall be burnt up?"

It may be objected to what I have said respecting the *solar* fire, that if it were so great and perpetual, there might be danger of the heavens being exhausted of fuel, and at length disabled of meeting the demands of comets. Moreover, the sun might be in danger of amassing too great a quantity of ashes. These objections may be just; hence I imagine the possibility of the sun being disburthened of his ashes at stated times by comets, either from attraction or repulsion resulting from different degrees of electricity in the comet and the sun's ashes. These ashes may then be carried off by the comet to distant parts of the heavens, where becoming somewhat condensed, by some means or other, they may be left by the comet, and forming a new body, revolve about the sun, until having become sufficiently impregnated with his rays, this body may be again seized by a comet, and carried to the sun for fuel. And thus there may be a regular revolution of a part of the sun's fire to him and from him.

Or, perhaps, there may not be always a necessity of the comet's parting with this ashy part of his body, when driven to remote parts of the heavens; it may retain it, and revolve with it, until it meet some other comet of a different electricity, when, rushing together, they may both fall headlong towards the sun. Or the sun may sometimes eject a too greatly accumulated quantity of his ashes by his own repulsion merely, which, on being driven into space, may become a new comet; and thus comets may be alternately formed and destroyed. These ideas may appear somewhat wild, but perhaps not wholly irrational, or indeed wilder than all the phenomena of comets.

ON MAGNETIC POLARITY.

HAVING thus explained the nature of the imponderable agents, and the source from which they flow, it comes next in order to consider, on the principle I have laid down, some of the phenomena, which those agents produce. In contemplating these phenomena, none appear to be more mysterious than the polarity of the magnetic needle; the reason why the magnetic fire with which it is imbued, should make it veer so perpetually to a northward and southward direction. Dubious theories have been offered to account for this. The following appears to me the most reasonable.

It is well known that the magnetic polarity is strongest, most regular, and general, in the equatorial, warmest regions of the earth. It prevails also with considerable regularity in the warmer parts of the temperate zones; but in general, as we depart from the warmer regions of the earth, towards either of her poles, the polar tendency of the magnetic needle is shaken, its variations become greater and greater, until at last it becomes of little or no use in navigation. A kind of magnetic equator has been traced through the central parts of the torrid zone, where the polar tendency of the compass needle is steady and strong with little or no declination, but as vessels depart from this equator, variations become greater and greater even to 80 degrees, so as to render the needle of no use, or to direct it to the east and west, rather than to the north and south. Now all this is easily explained on the following principles.

The matter of heat constituting electricity and magnetism, the warmer part of the earth's surface is positively electrified with regard to the colder or more polar part of its surface, which is negatively electrified. The sun is the rubber, if I may be allowed the expression, which constantly electrifies its warmer and more equatorial parts. The magnetic needle is a light body positively electrified or imbued with a kind of permanent degree of positive electricity. Of course then, it will be constantly attracted by the negatively electrified regions to the north and south, when situated between them. But it may be asked, will electricity act on so small a body from so great a distance? We have no reason to doubt it. If the slight electricity excited on the surface of a stick of sealing-wax, will extend its influence to a distance of four or five inches, and even through glass, shall not the constant electricity excited on the surface of the earth over millions of acres extend its influence some hundred miles? It is not necessary that electricity should come all the way from the poles to affect a needle at the equator; at a distance of two or three thousand miles or less from the equator, there may be difference enough in the earth's surface and climate to constitute a sufficiency of negative electricity to affect the needle at the equator; and so successively further and further to the north and south, electricity varying with climate. In the central parts of the torrid zone, the needle is equally attracted both to the north and south, from the equal distances of the two temperate zones, hence magnetical polarity is there the strongest. But as it is carried from those parts, to the northward, for instance, the north pole of the needle is observed to predominate over the south, as it is more strongly attracted by the propinquity of the north. And as it approaches the poles, and becomes somewhat surrounded by negatively electrified regions, its polarity is weakened, for it is partially attracted in every direction, more strongly, however, to the

north, until it arrives at the coldest parts of the earth, and comes into the midst of those parts. It is then wholly surrounded by negative electricity of earth and atmosphere, and is consequently attracted every way equally. Whither then shall it direct itself? Towards the warmer zones? They are in the same state of electricity with itself, and therefore would rather repel than attract it. It is wholly surrounded by an opposite state of electricity, and consequently attracted every way equally, which tends to render its motions sluggish and inactive. If it veers more to the east and west than to other points, it may be because rather more cold prevails in those directions, the immediate vicinity of the poles being somewhat warmer, on account of the aurora borealis, perhaps, or some other cause. Such I apprehend to be the general causes of magnetic polarity. Perhaps I should have used the term, magnetism, instead of electricity, in explaining them, and positive and negative magnetism, instead of positive and negative electricity, as the idea of electricity intimates something transient and less permanent than magnetism. I mean that the surface of the earth is *positively magnetized* in the *warmer climates*, and possessed of a *negative* degree of natural *magnetism* in the *cold climates*.

Other variations of the compass needle, which I have not spoken of, sometimes irregular and inconstant together with particular agitations of it even in the torrid zone, are all explicable on these principles. The diurnal and annual motions of the earth, whereby different parts of its surface are continually acquiring temporary accessions of heat and again losing them, and the different densities and capacities of different bodies or tracts of earth, must render elementary fire somewhat fluctuating or more or less abundant in different places, even of the same latitude. Hence the minor and temporary variations of the magnetic needle. For in the torrid zone, when it is brought near some volcanic or other

particular tract of earth, where either a much greater or less degree of elementary fire, constituting magnetism, exists from its own degree, it must then be particularly affected; and so also it must be in every other part of the earth wherever a state of magnetism prevails very diverse from its own. Thus iron on ship-board, regions of ore or mines, dense tracts of earth, or a particular prevalence or disposition of land broken into islands, may all sometimes harbour a particular quantity of natural magnetism or elementary fire, so diverse from that of a compass needle, as to overcome in some degree its usual polar tendency. The diurnal variations may be occasioned by these temporary changes of temperature, which are caused by the daily presence of the sun. If, in those central parts of the ocean, as of the Atlantic, where there is an open extension of sea far to the north and south, less variations are observed, it may be owing to the equal temperature and gradation of climate incident to such homogeneous tracts of the earth's surface.

I have been struck at observing before now the electrical or magnetical influence of heat at a distance in exposing by chance a sheet of thin letter paper to the fire in extremely cold weather. In this case, the paper will warp and curl at a distance of many feet from the fire, if the room is very cold, and the fire brisk. Indeed, all kinds of warping effected by an exposure to the sunbeams may be reckoned among those common effects of fire, which under different circumstances appear in the phenomena of electricity and magnetism.

ON COMBUSTION.

By combustion, we understand the burning of bodies. It is one of the most common of all the phenomena produced by fire. There are, indeed, few in this cold climate, who do not spend some part of their lives in gazing on this phenomenon by a comfortable fireside, however small be their curiosity to understand the real nature of the process. But from the tenour of our foregoing remarks and the obvious truth, that the matter of fire dwells universally in all bodies, there is no difficulty in understanding the process of combustion. It is merely the gradually evolution of elementary fire from the bodies, which are burning, and in which it existed before in a latent state. The evolution or developement of fire from burning bodies is more or less rapid and plentiful according to the quickness or slowness, with which the process is going on, and the nature of the body, which is burning or undergoing the decomposition, whereby its latent fire is uncovered and brought out to view.

There is no substance of the earth besides fire, but what may be burned or decomposed, when subjected to a sufficient intensity of this element. Fire of course cannot burn fire, but exists alone the great overruling element of all. No other matter can resist its penetrating power, or indeed, be fairly decomposed by any thing else, but faints and dissolves at its presence, being hurled from the union which it holds in the consistency of bodies; its countenance is changed into every hue of the rainbow at the presence of the mighty destroyer,

and it is sent away as if affrighted. Metals and stones can both be burned by the chemist, and it is well known, that water, although it generally quenches fire, is nevertheless combustible, for if a small quantity of it is thrown into a hot fire, it soon undergoes the general decomposition. Indeed, we are told, that on a certain day the whole earth will 'be burnt up.' What an eventual and complete mastery will that be of the element of fire over those other elements, among which it has been for so many ages a struggling.

Some bodies are more combustible or easily burned than others, and among these gunpowder is preeminent. The greater or less ease, with which a body takes fire, appears to be owing to a particular abundance of latent fire within that body. Not that such a body as takes fire most easily contains more of this element than any other body does, but more according to its capacity for containing it. Thus we are not to suppose, that gunpowder contains so much latent fire as iron ore, or half so much, but the best gunpowder contains as much fire, as the particular consistency of its matter will possibly allow it to, so that the addition of merely a spark will enable its fire to separate the elements which envelope it, and burst out from its prison-house with a sudden explosion. Common fuel requires the addition of many sparks, or rather hot coals, to increase its quota of latent fire so as to enable it to come out gradually to view by gradually overcoming and decomposing the matter of the fuel which envelops it; but as to any particular attraction of oxygen or union of electricities, so hard to be conceived of in the process of combustion, it seems rather imaginary. If, however, we understand by the electricities of air and fuel, which are said to unite in producing combustion, the elementary fire of air and fuel, the theory is then reasonable.

The hypothesis of Lavoisier, which supposes air to be the chief contributor to the fire of combustion, is now, indeed,

acknowledged to be imperfect. According to this hypothesis, 'several requisites are not fulfilled; the light depends upon the combustible and not upon the quantity of oxygen consumed; and there are very numerous instances of combustion, in which oxygen, instead of being solidified, becomes gaseous during the operation; and lastly, in others no oxygen whatever is present.' Air does, indeed, aid combustion, because the drier part of it is itself more combustible than common fuel, therefore, when it is blown upon fired fuel, it increases the flame by its own combustion, and always has a tendency to rush towards a fire to fill the vacancy occasioned by the combustion of its parts, which are in immediate contact with the fire. Oxygen gas is probably a sort of condensation of the finer part of air, impregnated with much latent fire; and on this account it is very combustible or a great assistant in the burning of other bodies. Hydrogen is more combustible than oxygen, since it explodes when fired on account of its extreme rarefaction and lightness, whence like other frail, light, and dry bodies, it cannot receive but a very slight degree of fire without being decomposed. Azotic air appears to be of a grosser texture and the more incombustible part of the atmosphere; therefore, it will not burn easily, but absorbs and extinguishes a small light.

Air is combustible, like other bodies, but as it is lighter and thinner than other bodies, it contains less elementary fire than they do, as it is evident from the unscorching nature of the common light, which constitutes its quota of fire. Air, on account of its subtile and evanescent nature, resembles fire more than any other body does, and on this account, the opinion has been advanced, that it is convertible into fire. The hypothesis of Lavoisier respecting combustion does not seem averse to it, since it supposes, that while 'the gas is uniting with the combustible, the heat and light which it before contained in the gaseous state, are evolved in the form of flame.'

But is there not a line of distinction, which separates the finest gas and the subtilest air from the element of fire? I think there is a line, which separates them as far apart as the east is from the west. The subtilest air appears to be a gross, sluggish, heavy body, when compared with any form of fire. Gases are ponderable, fire is not. Gases are decomposed by fire, and oxygen and hydrogen then take the form of water. Nitrogen cannot resist a great intensity of flame, but is decomposed and destroyed by it. The vivifying powers of oxygen are owing merely to its latent fire, with which it so much abounds, that when compressed, it becomes luminous. Indeed, is a gas of itself any thing more than refined vapour? The difference between them, or the circumstance, that a gas cannot be condensed into moisture by cold, as vapour can be, is not sufficient to constitute a difference of matter, for what reason have we to suppose, that gas could not be condensed into moisture by a degree of cold as much greater than is necessary to condense steam, as gas is rarer than steam? And is not steam as much finer than common mist, as gas is finer than steam? But what appears to settle this question is, that although gas may not be liquified by means of cold, it can be by other means, by pressure (Phil. Trans. 1822), and by heat, for oxygen and hydrogen turn into water on being burned. Therefore, does either hydrogen or oxygen consist of any thing more than water, if we except their latent fire? And what is nitrogen but a mephitic vapour? Is not the vapour, smoke, of a somewhat similar, light, and suffocating nature? Does not nitrogen consist of a certain vapour less refined than oxygen or hydrogen, and therefore of a suffocating quality? Are there not many kinds of vapour of a suffocating quality? Finally, does not the whole atmosphere consist merely of effluvia and exhalations raised from the surface of the earth by the sun's rays, and composing different sorts of vapour more or less refined, from the dark thunder-cloud to the finest

gas? Can the contrary be proved? Formerly, air and water were thought to constitute two elements. Now, they are said to consist of three, oxygen, hydrogen, and nitrogen; but do they in fact form more than one element, water? Is not the whole atmosphere of the earth one mighty rarefied ocean, as it were, in which men live and move, as fishes do in the sea? Common air is, indeed, not entirely pure, it has a mixture of earthy particles in it, and so has water; one is probably as pure as the other. If all this be true, air is a very different thing from fire.

It has been said, that vapour is capable of a higher temperature than solid bodies are; a wild assertion, for is there a more general law in nature than that all bodies have a capacity for heat according to their density? Hence so light a body as vapour must have a capacity for elementary fire as far inferior to that of solid, earthy matter, as it is of a slighter texture; and all that is said about the very high temperature of flame must be hypothetical. What? Common flame or red-hot smoke of such a withering heat? And can we not hold and turn our hand in it for many seconds without the least harm? Can we not even hold the flame of a candle in the mouth without suffering any injury? Whence then this monstrous capacity of smoke for fire? It is said, if you hold a coil of fine platinum wire in the flame of a spirit-lamp, it will become white-hot. Any other substance could be made white-hot as easily as platinum, if it possessed the same density. White-heat discovers the pure, native colour of the substance of heat, where it is so abundant as to prevail over the tincturing qualities of the matter it resides in. The white heat of the platinum wire is not a test of the high temperature of the flame, but only of the capacity of this metal for fire. The flame of a lamp is white or white-hot smoke from the same predominance over the less obscuring quality of the matter, smoke, not its great capacity for fire. Also the immersion of the wire

into the flame, whereby every part of its surface comes in contact with the flame, is the reason why flame affords the heat so readily, from the same cause, that we experience more heat by thrusting the hand into hot water than by laying it on a piece of metal, that in reality contains much more heat than the water; or when we thrust the hand into cold water, we experience more cold than by laying it on much colder earth. It is the complete contact of the parts of bodies, that affords the readiest transmission of heat. If by flame, however, is ever understood pure fire and not merely heated vapour, in this sense, there is, indeed, nothing hotter in the world.

ON COHESION.

By cohesion we understand the adherence of the particles of bodies to one another, whereby bodily forms are preserved. It has been said to be impossible to assign a satisfactory cause for this very common, though somewhat mysterious phenomenon; but, if I mistake not, a very probable cause may be found for it, and it may be shown by experiment, that the element we are contemplating, is the principle cause of this and every other kind of attraction whatever. Elementary fire appears not only to effect the cohesion of all the bodies we behold, but of the whole earth, which we cannot entirely behold; it chains the whole earth together in a spherical form, as it does a drop of falling water, and if the earth were bereft of it, she must immediately sink into her original chaos. Ay more, it is probably this same cause, (the element of fire and light that Deity created, when he said, "let there be light,") which first drew up the earth out of chaos into a globular form, in the same way as it now draws together water, that is cast on a dusty floor, into globular drops. We have a right to infer the cause of the earth's cohesion from the same experiments, by which we ascertain the cause of cohesion of smaller bodies, the earth being only a great body of the same composition as the latter, little ones, and as we also extend the law of gravitation to the planets from observing a stone fall to the earth.

It should, indeed, be expected, that the experiments, by means of which we detect so remarkable and general a cause, should be of a fair and striking character. And so I imagine they are, plain, multiform, and repeated every day. One class of them consists of no more or less than every process

of combustion. During combustion, every body, however solid its cohesion was before, falls to pieces by passing into a state of vapour and ashes, and consequently divests itself of the cause of its former cohesion. Is it not then at once obvious of what this consists?—the fire, which leaves the body gradually, as it falls to pieces? especially, when it is well known, what wonderful attractions this element exerts in the states of electricity and magnetism? Before burning, the body existed in a solid shape, and possessed its quota of latent fire; after burning, it has evolved this quota of fire, and with it its cause of cohesion, since its vapour, which has escaped the flame, is dispersed in the atmosphere, and its ashes scattered about by the winds. And so it is with all bodies; all are decomposed and crumbled to pieces on being burned, during which process, they part with the fire, that dwelt in them before in a latent state, and effected their cohesion.

Another class of experiments of an opposite kind, tend to elucidate this point still more. We see in a very striking manner, what bodies lose during decomposition, and hence we infer what it is, that prevents their decomposition, but this becomes more evident on observing what bodies gain during processes of composition. As, for instance, out of meal and water, substances somewhat resembling ashes and vapour, we can make soft dough, which, on being thoroughly impregnated with the matter of heat in an oven, forms a crust, that coheres so strongly, the stoutest jaws can hardly separate it. Is it not fire which has effected the strong cohesion of this new body? Take another instance. Soft clay, that cannot resist the least impression, so weak is its cohesion, on being exposed to the sun-beams, and imbued with fire in a brick-kiln, acquires a cohesion equal to that of a rock. Indeed, all processes of hardening, drying, or baking of bodies, which were before soft, by exposure to fire or the sun, are of this kind; and with processes of decomposition, show the cause of cohesion. Fire does what it pleases with other bodies.

When its presence exceeds their capacity, it pushes apart their particles, but when existing in a smaller quantity it holds them firmly together. This power of fire is indeed mysterious and wonderful, but not more so than its whole nature. It accords strictly with the common phenomena of electric attraction and repulsion, and therefore cannot be accounted impossible.

The composition or formation of living bodies also, is attended by an acquisition of the same cohering cause, whose excess is then called animal heat. Of a sudden, we see a vegetable body, breaking forth from a little seed, and as it imbibes more and more of this element, we see it swelling and forming itself into a cohering, beautiful shape. We see another little body popping out of another kind of seed, an egg, and gradually swelling to a certain bigness in proportion as it acquires more of the same important substance. A similar acquisition attends the formation of all organized bodies, whether animal or vegetable. Do they not all owe their consistency to the same, all-pervading element, which always leaves them when they return back again to dust?

Finally, if we examine the consistency of the different sorts of matter, we see that in proportion to the hardness and density of bodies, or their strength of cohesion, so generally is their capacity for elementary fire. Thus, metals and minerals, which have the greatest capacity for heat, and consequently, contain most fire naturally, are the bodies, which cohere most strongly, because they contain, according to their quantity of matter, most of the cause of cohesion. On the other hand, vapourous and other light bodies, cohere most weakly, because they naturally contain the least of the same cause, and are not able either to give out much of it on burning, or to contain much without decomposition. Indeed, it is a sort of law, that according to the quantity of matter or density of a body, and consequently its natural quantity of latent fire, so is its strength of cohesion.

Gravitation may be called a tendency to cohesion on a large scale. The tendency of bodies, when lifted from the surface of the earth, to return to it, is little different from the general tendency of the particles of bodies to stick together, for, regarding the earth as one great body, the little bodies which rush to its surface when raised from it, are only its particles, which desire to cling to it, as the particles of any other body have a tendency to adhere together. Indeed, what are all attractions but a tendency of one portion of matter to adhere to another? All are of one nature, and all are effects of the same superior element, which has often been dimly pictured in the imagination of philosophers under the form of a certain, subtle ether or invisible fluid. Newton supposes such a thing as being the cause of gravitation. But neither has man ever seen, or will he ever find, any subtle ether or gas, or any imaginary sort of fluid, either in the heavens or upon the earth, whereby to account with certainty for these effects, but what consists of the substance of fire. This is sufficient, why seek for any thing else? It is all air, gas, or fire, and the finest gas may be as much inferior in subtility to fire, as a rock is smaller than a mountain, else light could not diffuse itself with so much velocity and ease among all the minutest particles of this gas. In electric and magnetic attractions, we see what influence elementary fire exerts on bodies at a distance. These attractions may be regarded as a sort of attraction of gravitation in miniature. Both are effects of the same cause. Indeed the *earth* has been often called one *great magnet*, and as such, it must of course *attract* bodies of its own nature to its surface in the same way as iron filings cling to a small magnet. The familiar phenomenon of the attraction of a loadstone or an electrified body is amply sufficient, I think, to account for the phenomena of gravitation; and there is a strict analogy, as far as circumstances will admit, between the repulsion exerted by the same and the expanding effects of heat.

ON COLOURS.

Another effect of the solar element, not less common than combustion or cohesion, is the developement of colours. Newton's theory of colours supposes, that the primary colours of the rainbow or prism consist of differently coloured rays of light, which are separated and displayed by the refracting power of falling rain or the prismatic glass, though in the common state of light, these colours are concealed. Then it supposes, that the colours of all bodies are occasioned by their absorption of all the rays of light but those of their own respective colours; these are reflected. Thus, a green body absorbs all but green rays, a red one all but red rays, a black one absorbs all, a white one reflects all.

If this theory can be made to appear rational and true to sensible men, let them still go on believing it, but if it cannot stand the test of a little blunt enquiry, by which it seems to be seldom tried, shall it still prevail because it came from Sir Isaac Newton? But would it not be somewhat curious, if this theory, notwithstanding the prevalence it has had, could be shown to be a complete fiction of the brain, sent abroad into the world under imposing circumstances, and received from a blind submission and dark views of the true nature of light? Yet if we are told that white is black, and black is white, shall we believe it? And are we not told here, that the pure light of heaven, which has always appeared to all eyes of a celestial whiteness, is blue, red, green, and what not?

It is said, that the seven primary colours, red, orange, yellow, green, blue, indigo, violet, when blended together, form white light; and how are we to know this but by mixing them together, as for instance, in paints? But blend together these seven colours of the finest paints, or dies, or tinctures, in whatever proportion you please, and will the result be of a white colour, or any thing like it? Will it not be only a medium between the lightest and darkest of the seven colours? It is said, if you paint the upper flat surface of a top with the seven colours, and set it to spinning in the sunshine, it will appear white;—indeed, and will it not also if there be no colours at all put on it? If some liquids are mixed together, different colours result, but this is owing to a chemical process, a conglomeration or rarefaction of particles, whence greater or less degrees of opacity follow in a different manner from what they do in the refraction of light.

The following experiment was made by Newton (Cam. Physics. Optics, p. 160.) to show, that the seven prismatic colours, when combined, form white light. Let the colours of the prism be formed in a darkened room by means of a few rays of light let into the room through a small aperture. Let a lens be then placed between the prism and its colours. The lens contracts the few rays, which pass through the prism, into a focus of a white colour, as all foci of light are. Then the paper, on which the prismatic colours are cast, is put into this focus, and of course the white speck of the focus falls on the paper, where the seven colours did before; hence, says this great demonstrator, those seven colours are changed into that white speck of light. Wonderful metamorphosis! Who else could have thought of such a thing? Who else ever did before him? Other experiments of this nature, and of perhaps equal weight, are adduced by this mathematician to prove his theory.

But waving such arguments, for they are of too sublime a cast for vulgar conception, what right has any one to call the prismatic collection of colours, light only, any more than to call the refracting body light? Rays of light are blended with both, and is not one as diverse to all appearance from light itself as the other? Can these hues shine like light? Can they warm, like light? Can they burn like light? Can they ever be found free and diffused, like light, and not always chained to a refracting body? How is it, that light is metamorphosed into such a different creature merely by passing through a prism? The fact is, the colours of the spectrum are merely *qualities of the prism*, a shadow of the prism, as it is evident from two circumstances; one is, that some of the light which falls on the prism is reflected; and the other is, that a delicate thermometer discovers less heat in the spectrum than out of it. The spectrum is a varied shadow, varying from the lighter hue, red, to the darker one, violet. The brightest hue always corresponds to the thinnest part of the prism towards its vertex, because there light finds the easiest passage, and consequently, illumines that part most. The violet corresponds always to the thickest part of the prism, towards the base, where light finds the most difficult passage, and of course illumines that part least, casting a darker shadow. The intermediate colours are brighter, opposite the thinner parts of the prism, and darker opposite the thickest. This correspondence of colours to the more or less illuminated parts of the prism, where more or less light is transmitted, is made further evident by a thermometer, since this discovers greater heat in the brighter than in the darker colours. Hence colours are merely qualities of coloured bodies developed by means of light, which illuminates them.

The supposition of the rays of light being heterogeneous or some of them more refrangible than others, because some are turned further out of a strait course in passing through the

prism than others are, appears to be equally groundless as the idea of their being coloured, for is there not sufficient evidence from the commonest phenomena of the refraction of light, of the same light being refracted most, where it permeates the greatest quantity of matter as at the base of a triangular prism? Does not light always deviate more and more from its former strait course, the further it penetrates any transparent substance? And is it not a natural consequence of the tendency of matter to absorb it? Cannot the very same ray of light be more or less refracted, as it is made to enter different quantities of matter? Are not all these circumstances confirmed by thousands of the plainest instances? What idea then is this of heterogeneous rays of light, some being more refrangible than others?

If the colours of bodies consisted merely of reflected light, we should expect to see them brightning and decaying every moment according to the quantity of light, which is falling on bodies. But the very reverse of this is generally the case, especially with artificial colours, where the liveliest tinctures are often faded away by exposure to the sunbeams. Delicate colours are always obscured, when intense light is shed on them. Indeed, are not the fairest colours always the most clearly visible in a room out of the way of the sunbeams or rays of light issuing from any fire? And can it be shown, that any light at all is reflected in this situation? Light is diffused in a moderate quantity throughout the atmosphere of the room, and all bodies absorb it; how can we suppose that under these circumstances, it is reflected? When it falls in streams on bodies, then is it reflected. At any rate, no light can be reflected, where no light is, as in a totally dark room, but cast a red-hot piece of metal or a parcel of living coals into such a place, and will not the brightest hues of red be seen, where so far from being any reflection of light, there is only an emission of it from the coloured bodies? Can you not see the

ruddy colour of flame also, or the glaring eye-balls of a wild-beast under similar circumstances? Whence come those millions of red specks, which adorn our meadows of a summer evening, emitted from beneath the wings of the fire-fly? Are they not qualities of those sparkling, little creatures?

According to the Newtonian theory, whatever be the consistency of a body or its capacity for the element of light, if it is of a white colour, it must reflect all rays, if black, absorb all. But is there any body in nature, which will not absorb light, or grow warm in the sunbeams, whether it be white or not? This theory is connected with the idea, that light is intangible, which we have disproved, and contains no substance of heat, a circumstance which never can be proved. Who can give a reason, why a body should reflect all the rays of light, merely because it is of a white colour, while another body of the same consistency absorbs all, because it is black? Black absorbs all? It is false. Set a polished black surface against a current of sunbeams, and is it not capable of reflecting them even to a dazzling of the eyes? The same may be asked of all coloured bodies, why they should reflect all but such and such rays, because they are of such and such colours, though of the same polish or density. We have the evidence of our eyes, and the bright firmament of heaven, and the glorious sun a rolling there, that pure fire and pure light have no other hue than that of a celestial whiteness, for we are constantly beholding them in all views, and although in common combustion, they often appear of a more sombrous or ruddy hue, this belongs wholly to the grosser matter, which they illumine, and by which they are obscured.

Colours are qualities of the body on which they appear. When light is absent, these qualities are concealed, but as light abounds, they are brought forth to view. As matter is more dense and opaque, more fire is requisite for the developement of its native hues, yet it always discovers a beautiful

red colour on being heated red-hot. This colour belongs to all terrestrial bodies, for all are capable of assuming it on being sufficiently heated. The denser sort of bodies are capable of assuming it without suffering decomposition; others, which cannot bear this heat, assume a red colour in the vapour of flame, or when reduced to ashes, for ashes may be heated red-hot. Thus, it being fully ascertained, that all bodies are capable of assuming a red colour, and all the other colours being known to accompany certain inferior degrees of fire, we may conclude, that *every particle of the earth* is capable of assuming *each* of the primary *colours*. In the rainbow and prism, red corresponds to that part of the refracting substance, which is most enlightened, and all the other colours decrease, or vary from red to violet, as they answer to the parts of the refracting substance, which are less and less enlightened. Hence, the same substance, glass or water, is here shown in a single, beautiful experiment to be capable of assuming each of the primary colours, and so it is in all probability with every particle of the earth, for other kinds of matter besides glass, water, and ice, discover the same phenomenon; even metals do, since when the electric fire, for instance, is discharged upon a plate of metal, it develops all these colours in circles around the point upon which the discharge is made; the red forming the inner circle or part most affected by the fire, and the other colours recoiling in due order as the developing cause is diminished.

Organized, living bodies both of the vegetable and animal kingdoms are generally adorned with the most beautiful colours, and offer the widest field and most abundant variety; and the torrid zone, where the element that develops them is most plentiful, affords the richest assortment. The tints of flower leaves are not fully developed, till the sunbeams have had time to rest on them, when they are so easily brought forth on account of the refined, juicy consistency of their frail

texture. The fragrance of flowers also results from the same refined secretions, whose colours are brought out by so little of that matter, so much of which is necessary for developing the same in grosser substances, as metallic and earthy bodies. Common leaves and grass, being of a less delicate texture, have only the darker colour of green brought forth by the same quantity of light, which brings out the liveliest tints of flowers.

The fanciful colours of clouds and vapour, which intervene between us and the setting sun, are illuminations of those bodies by the opposite sunbeams, developed oftentimes in the very contrary way from what they should be, if consisting of reflected light; since the rays and their reflection are wholly concealed from us by the coloured vapour. Warm blood owes its redness to the heat it contains, since when it is brought into the air and left to cool, it turns to a dark hue.

ON THE PLANETARY MOTIONS.

GRAVITATION is with propriety extended to the planets and satellites, which revolve about the sun. They may all have a tendency to fall down to the sun or their primaries in the same way as a stone hurled into the air has a tendency to fall to the earth. This law, however, is not wholly universal, since fire, the most extensive of all the elements of matter, pervading all the planets as well as the earth, blazing in the stars as well as the sun, and stretching throughout all the immensity of space, is itself imponderable, darting upward as easily as downward, and diffusing itself with the rapidity of lightning through all bodies. When it is emitted from a candle, it flows off in every direction with equal ease and velocity, and, indeed, it is constantly 'issuing from the sun in directions contrary to gravity.'

But has the sun itself no weight? If his fiery part has none, yet his combustible part may, and it is necessary that a part of the sun's body should consist of passive, cohering, and combustible matter in order not only to support his flames, but also his very form and compact mass, for if fire has not a sufficient attraction or affinity among its own particles, it would be impossible for it to subsist, independent of any other matter, in a fixed body by itself. Allowing the sun, then, to have weight, whither shall he fall when all other bodies are falling to him? Is he supported in his fixed position solely by his gravitation in different directions to the bodies, that move about him? If this were the sole cause of his fixedness, would there not be some

danger among all the diverse revolutions and masses of the planets and numerous wild comets, and withal of the decay or change, which these masses may undergo in time, that the same quantities of matter would not always be found on the different sides of him, or that a greater quantity would not sometimes collect on one side than the other, and so draw him off from his centre? It seems, that no less than Infinite Power were able to preserve this constant equilibrium of the heavenly bodies, if it were gravitation only, which held the sun in his place. Hence, I conceive, that another very important concurring cause of this consists in the electric repulsion which the sun sends off in his rays in all directions, thus procuring him a sort of independence of his satellites for his standing in the midst of them. Electricity consisting of pure fire like the sun's, and he sending off this fire in such continual torrents, what hinders that he should send off immense powers of electric repulsion in these torrents to resist the gravitation of his satellites towards him, and to be a principal cause of his own firm and fixed position in the midst of them, seeing that they are so dependent on him for their life, light, and support?

Knowing that the electric fluid consists of fire, and consequently, that electricity is a property of fire, it is certain that the great fountain and source of fire must possess vast powers of electricity, and like a highly electrified body be able to send off great forces of repulsion in the direction of its rays. Nor are its electric powers in danger of failing, since its emission of fire is perpetual. What then is so agreeable to nature and experience, the order of the heavens and the system of the universe, as to suppose that the motions of the planets are governed by the powers of the solar fire? being all kept at their distances, as they revolve about it, by the force of its electric repulsion? The planets being electrified by the sun's rays, what is more certain or strictly accordant to all electrical phenomena, than that they should be repelled from him?

While at the same time their gravitation towards him offers a resistance to this force, which might otherwise drive them wholly off, and keeps the planet at just such an equable distance from the sun, as where the gravitating and repelling forces equal each other, and hold an equilibrium. We have no need of building up this doctrine on the dark faith of mathematical diagrams, and calling to aid all that is abstruse, I will not say to hide its defects. We have direct experience to confirm it, and numberless experiments. What are better known than the powers of gravitation and electric repulsion?

Take away the force of repulsion from the sun, and let the heavens go on according to the system which astronomers have taught, and observe some few of the inconsistences, which arise. All the planets gravitating to the sun and the sun to the planets, what great and constant force is it which keeps them from rushing together? The centrifugal force of the planets. From whence does this force arise? From the original impulse or projectile force which they received from the hands of their Creator on being first launched into space. Is this the only cause of the centrifugal force? Ay. How is it, that this force is not impaired by length of time, as all other forces, which arise from single impulses? No resistance is made to it, that might overcome it, as there is no etherial substance in the heavenly spaces, which might oppose the progress of the planet through it. Granting this, yet does not gravitation offer a constant resistance to the force of original impulse? Nay. What? Gravitation offers no resistance to projectile force? Is it not the weight of a cannon ball, which overcomes the impulse the cannon gives it, and is almost the sole cause which brings it to the ground? When a stone is hurled into the air; is it not the stone's weight, which quickly overcomes the force that sends it? Is it not gravitation, that brings all bodies directly downward, whatever be the force which for a moment opposes this tendency? By what wonderful exception, then,

to all experience is it, that when a planet is hurled into space, it should not fall down to the sun, as a stone does to the earth? Away with mathematical sophistry and vain imaginations averse to all experience. So sure as it is a stone's weight, which overcomes the impulse, which sends it into the air, and brings it down to the earth, so sure is it, that it is a planet's weight, which, after making all allowance for diversity of circumstance, must presently bring it downward to the sun, if there existed no repulsion to oppose it, and with the utmost violence. It is in vain to pump the heavens empty of all etherial substance; the planet would then fall so much the quicker and more heavily, as it is well known, that even the lightest feather in the vacuum of an air-pump will fall like a stone. Nor, if it were possible for a planet to revolve about the sun merely from the cooperating influences of gravitation and projectile force could the planet be said to resist any predominating influence of gravity by any increasing impetus it might acquire, the further it proceeded on a half falling course; for although a body falling a great distance directly downward may acquire increasing force the further it falls, yet wherever a body moves in a circle or ellipse, no such thing is known to take place.

How untrue then is the common theory of the cause of planetary motions; fictitious, and averse to all, ay, and the commonest experience. It supposes, that if a cannon ball were shot off from a high mountain into a firmamental vacuum, it would never fall to the earth, but go on incessantly revolving about it in precisely the same orbit. (Cambridge Physics, Ast. p. 345.) But the largest ball, that was ever yet thrown off from a high mountain with the utmost force, that could be put to it, never travelled but a very short distance, before it came to the earth with violence. And shall a vacuum diminish this obstruction of gravity to simple impulse? On the contrary, is it not known from experiment, that the overcoming influence of

gravity on the lightest body cast into a vacuum, is immediate and decided? If a body were sent into firmamental space out of the reach of all attraction as well as every other resistance, it must then, indeed, move on incessantly in a straight course; but once allow even the slightest attraction of gravity to reach it and act constantly upon it, and the projectile force or simple impulse, which first moved the body into space, must be quickly worn away; and no new and constant force resisting this power of gravity, it must immmediately plunge the body into the source which draws it. Whatever in this case might be the original impulse, which a body, like the earth, could receive, if it constituted the only opposition to the incessant attraction of gravity, however slight this attraction were, if it acted perpetually against a measured, momentary impulse, it must eventually overcome it, and the earth had been ages ago smoking in the sun. How astonishing then is it, that such a notion could ever have found place in philosophy!

The elongated ellipses of the comets' orbits also, with the sun in one of their foci, is most unaccountable and inconsistent according to this theory of the planetary motions. While on the other hand, the position of the *tails* of comets, which are *always turned away from the sun* in every part of the comet's orbit, affords the most striking intimation of the electric *repulsion of the sun*, which is always blowing them off.

It is the electric powers of the sun, which forbid the descent of the numerous bodies that revolve about him, keeping them at just such distances, as where the repulsive force and the gravitating force equal each other, and hold an equilibrium. Hence, the quantity of heat which a planet receives from the sun, may be always the same; for supposing the sun's fire were ever to increase or diminish, his electric repulsion would increase or diminish with it, and consequently the planet would approach and retire in the same ratio to preserve the equilibrium of the repulsive and gravitating forces. This

is a wise provision for the equable and constant temperature and well-being of the planet and its inhabitants, which seems to be left wholly out of question in the other theory, as though it were a matter of little importance, whether we were alternately burned or frozen up by the sun's heat, if this heat were ever at all inconstant.

But whence come the revolving and rotatory motions of the planets, now they are kept at this sure and comfortable distance from the sun? Are the sun's electric powers in any way sufficient to produce them also? Have no electric phenomena been ever observed, which infer or prove the sun's ability of producing them, while his repulsion keeps the planets at their distances? Such phenomena have been observed, even so as to suggest a doubt, whether any other immediate cause or impulse were necessary to have set the planets in motion at first, fire being the agent whereby Deity first formed them, and has ever since managed them. The planets may have taken their respective distances according to their quantity of matter or the weight of each. Thus, the heaviest would be found nearest the sun, where it might find a repulsion strong enough to resist its weight, repulsion being stronger, as we approach the sun. And the outermost planet would be the lightest; thus Mercury may be heavier than Jupiter; and Ceres, Pallas, Juno, or Vesta heavier than Uranus.

In 1741, Charles Orme of Leicestershire, England, observed one day that his glass tubes, which he was drying by the fire, and which he used in making barometers, had got into "a rotatory motion about their axes, and at the same time a progressive one towards the fire." Struck at this singular phenomenon, he communicated it to Granville Wheeler F. R. S. This gentleman repeated the experiment in many different ways, and ascertained it to be a constant effect of the fire, and what was more surprising, that it did not depend upon a high degree of heat, but succeeded best at a certain

middling temperature of the fire, and "if the tubes leaned to the left hand their motion was from *west to east.*"

He found that a tube would begin to revolve at about 'eighteen inches distance' from the fire, and continue rolling towards it, until it struck the bars, which separated it from the fire, and even then, it would continue to revolve while resting against them. These new and extraordinary facts, from which may be directly deduced the sun's power of rolling along the planets before him, were communicated to the royal society in 1745. (Phi. Trans. vol. 43.)

There are many ways or experiments for demonstrating the power of electric fire to produce motions similar to those which the sun produces on the planets, among which are the following. Set up a brass ball on the top of a brass wire about two feet long, inserted in the prime conductor of an electrical machine. Let this ball represent the sun. Then cut a piece of India paper in the shape of an isosceles triangle for a planet, and on electrifying the conductor and of course the brass ball, "bring the obtuse end of the piece of paper within the atmosphere of the ball; let it go, and it will revolve round the ball, turning often round its own axis at the same time!" Could any thing be plainer?

Again, let the 'knob of an electric jar' be the sun. Let a hollow ball of cork about an inch in diameter be a planet. Suspend this planet of cork by a silk thread three or four feet long over the knob of the electric jar, and on first touching this knob, the cork "will be repelled to a considerable distance, and after making several vibrations will remain stationary; but if a candle be placed at some distance behind it, so that the ball may be between it and the bottle," (not totally unlike the fires of the fixed stars, which are exterior to the planets,) "the ball will instantly begin to move, and will turn round the knob of the jar, moving in a kind of ellipsis, as long as there is any electricity in the bottle." It is remarkable,

that these motions of the cork ball "always affect the elliptical rather than the circular form!"

Again, let the prime conductor of an electrical machine be the sun, and hang six metallic hoops upon it one within another at different distances from one another, so "as to represent in some measure the proportional distances of the planets." Then place a glass bubble for a planet within each of the hoops on a metallic plate. "On electrifying the hoops, the bubbles will be immediately attracted by them, and will continue to move round the hoops, as long as the electrification continues. If the electricity is very strong, the bubbles will be frequently driven off, run hither and thither on the plate, making a variety of surprising motions round their axes; after which they will return to the hoop, and circulate as before, and if the room is darkened, they will all appear beautifully illuminated with electric light." (Encyclopedia, Dobson's, vol. vi. p. 538.) Thus it appears that the sun's electric powers, possibly somewhat assisted by the influences of the fixed stars, are abundantly sufficient to roll, move, and govern all the bodies, which revolve about him without any recourse to an original impulse. It was as easy for Deity, when he said, "Let there be light," to give this element power to execute his purposes respecting the material world, as to leave these purposes to the immediate agency of his spirits, or other mysterious means, and much more becoming his dignity and power, I imagine.

The revolutions of the comets, that numerous class of planetary bodies, are very different from the other planets, their orbits being very elongated and some of great duration, having the sun in one of their foci. Yet, if it is the function of these bodies to supply the sun with fuel, as there is reason for supposing, then, their peculiar motions and appearances are easily accounted for. It seems, that these bodies are of peculiar tenacity, else they could not endure so well the changes to

which they are exposed. Supposing them, in the first place, to be revolving about the sun like the other planets, yet exterior to them. In the course of their travels they might fall in with some other bodies of an opposite state of electricity or not so well organized as the common planets, (for who can tell what there may be between us and the fixed stars,) attracting these to itself, the enlarged body of the comet may be so increased in gravity as to surmount the sun's repulsion, and set out on a fall towards him, until on near approach the comet's load, on account of its peculiar state of electricity, may be rent away from it by the sun's attraction, and drawn to himself, while the disburthened comet, on the loss of its load, may be driven off by the sun's repulsion to its former place in the heavens. Or comets may sometimes fall themselves to the sun, and be again formed from his ashes. The firmament may be purified or divested of refuse matter, perhaps, those bodies which are of a proper consistency and sufficiently electrified being kept at their distance, while other grosser bodies of a different state are haled to the sun, he assisting the comet in its fall by his attraction of this matter. Thus we can conceive, if necessary, of a planet growing old and cracking to pieces, and of these pieces being caught up by comets and carried to the sun.

Satellites revolving about their primaries, as the moon about the earth, is only the same scene as that of planets moving round the sun on a smaller scale. The rotation and peculiar motions of the sun may be only a natural consequence of the electric action of his flames and the influence which the gravitation of the bodies that revolve about him may exert upon him. It is said, that the planets attract one another. This would be a very dangerous circumstance, if there was not a counteracting repulsion; so many bodies being let loose in the heavens with such diverse motions, if they all had an unopposed tendency to rush to one auother, what hazard, what uncer-

tainty, what peril, would there be of their running athwart of each other and producing no unfrequent 'crash of worlds.' It is not so. The planets, which we see, are all electrified by the sun's rays, and of course they must be generally in similar states of electricity, and consequently, repulsive of each other. Hence, they may circulate among each other in perfect harmony, and never be in danger of rushing together. Those effects, which astronomers have thought to arise from a mutual attraction of heavenly bodies, may be owing to the very opposite cause, that of repulsion. There is more analogy, I imagine, than every one thinks of between the phenomena exhibited by an electrical machine and those which are exhibited in the heavens. It is the same great element, I conceive, that of the sun, which governs the motions of the vastest world, that rolls in the firmament, and the humblest particle of dust that lies beneath our feet. The revolution of the moon about the torrid or warmest zone of the earth rather than about the colder parts of her surface shows, that it is the superior heat of this part of the earth, which governs the moon's motions; and so it is with the satellites of the other planets, they revolve about the warmest zones of their primaries.

ON THE TIDES.

According to the tenour of our foregoing remarks, it may be anticipated that we should clash with another prevailing theory not very foreign from this part of our subject,—that of the tides. It is well enough to hold to one theory, if it be not too absurd, until we can find a better; so agreeable is it to the mind of man to be able to assign causes for common phenomena. And so highly necessary does it seem to those who pretend to philosophy to be able to give a reason for all things, that if nature will not furnish them where one is wanting, they do not often hesitate in endeavouring to invent one. Such, I conceive, to be in some measure applicable here also.

The tides are said to be occasioned principally by the waters of the ocean being attracted by the moon. As the moon passes over the earth, she is said to draw up the waters of the ocean towards her, so that a great swell of the sea rolls round the earth after her, which causes the rising and falling of the tides. Allowing the sun also to assist in causing this swell of the tides by his attraction, let us see what inconsistencies arise. High tide is occasioned in our latitude by a flux of the ocean northward, as it is evident from the superior height of the tides in those bays which open to the southward, and thus offer a direct impediment to them, as the bay of Fundy, where the tide is said to rise sometimes forty feet, and even to overtake cattle on the beach. The mouth of the Indus has a tide of thirty feet. Do not the tides flow southward likewise on the other side of the equator? But is not this motion of the wa-

ters northward and southward of the equator, in producing high tides, the very reverse of what it should be, if it was caused by an attraction or lifting up of the waters under the moon, which is almost always directly over some part of the torrid zone?

There is another incongruity in this theory, which is subject to much ridicule. It is this. While there is a high tide on one side of the earth under the moon, there is also a high tide on the opposite side of the earth; and to account for this, it is said, that the latter tide is occasioned by a pulling away of the earth by its little moon from this part of her waters, thus leaving them to swell up of their own accord, while the other tide under the moon is attracted upward in an opposite direction. Thus, it is as easy for the earth to be drawn away from her waters, as for her waters to be drawn away from herself; and still more, it is as easy for the waters to be drawn away from the moon by her own attraction, as to be drawn towards her by the same cause!

The moon has some influence upon the tides by her repulsion; how much, however, I will not pretend to say; only this I would dare to propose, that the sun is the principal cause of them. The moon and sun moving in nearly the same range or plane of the ecliptic, it is not surprizing that the effects of the one should be mistaken for the effects of the other; especially as the moon modifies the tides to a certain degree, according to her position in regard to the sun. It is said, that it is twice high-tide in a lunar day, yet it is as easy to refer this coincidence to chance as to suppose the moon capable of exerting such an immediate and unvarying influence on the sluggish and unwieldy ocean; or to deny that the retardation of successive tides is not a natural consequence of a tardy obedience to the daily motions of the sun. It is said, that there are the highest tides when the moon is nearest the earth; yet it must be recollected where the sun is at the same

time. 'These elevations and depressions of the sea are most conspicuous when the moon and sun are nearest the earth; and they diminish as these bodies recede;' so that to say the tides are principally the effect of the moon, exclusively of the sun, is a very adventurous assertion. If the sun and moon were equally massive or equally distant, we might then with some propriety 'halt between two opinions,' but knowing the insignificancy of the moon when compared with the sun, and all the superior effects of the latter upon the earth, and the vast forces of repulsion, which he constantly exerts upon her surface in resisting her forces of gravitation towards him, it is impossible any longer to doubt. The tides are occasioned chiefly by the sun, instead of the moon, and that too in the very *opposite way to attraction;* it is done by repulsion.

The oceans constituting a very yielding part of the earth's surface, it is most natural to suppose that the sun's great pressure of repulsion exerted on their surface should make them oscillate, as they do in producing tides, and gush upon her shores and into her harbours. The motions of these waters to the northward and southward of the equator among other directions in raising high tides or flood sea is a proof of the sun's more direct repulsion, which he pours in his rays upon the warmest part of the earth's surface, driving her waters northward and southward. The spring-tides, which happen at the equinoxes, may be natural results of the sun's approach to the equator, since his strongest repulsion must always be directly below him, where he sheds most light.

Tides recur after regular intervals all round the earth, and that too, by night as well as by day; how happens this? The oscillations or depressions of the sea by the sun's repulsion may be naturally supposed to be regular, since the sun is regular in his return to every part of the earth; hence the repulsion of his rays, which always follows him, must pass and repass over the sea regularly, corresponding to the regularity

of the tides. But as the motion of water is so much more sluggish than that of light, we cannot expect to see it obeying the impulse of the sun's light immediately, so as to always retreat exactly before his progress, and overwhelm or gush upon our shores always at the same time in the afternoon, when the sun has been all the hottest part of the day exerting his more immediate repulsion upon the sea, nor then always ebbing back as darkness approaches. Yet it is a remarkable circumstance that the time of six hours, which it takes a tide to rise, corresponds to the hottest part of the day; days in general being twelve hours long, it is not more than six of these hours, that can be called the hottest part of the day. This or a trifle more is the time a tide is rising in obedience to the more immediate repulsion which the sun sends upon the earth with his light during the hottest part of the day.

When the waters of the ocean have once got to oscillating or into a swing, they will not immediately abate their motions during the short, nocturnal absences of the sun, any more than any other larger body, when it has once got to oscillating, will immediately cease, when the moving cause is for a moment suspended, as it is familiarly exemplified in the diversion of swinging, which young people indulge in. When the person swinging has once got into motion, it only needs a slight push at regular intervals to keep up the oscillation. So it is with the tides. The sun gives them a push once a day by his electric pressure. They will not even linger during nighttime, the push is so equable and constant, as the waters of the ocean pass daily beneath the direct repulsion of the sun.

The moon, revolving about the torrid zone in obedience to the electrical or magnetical influence, which the earth acquires from the sun, and being kept at her distance by the electrified earth's repulsion, exerts back again on the earth's surface some degree of mutual repulsion, apportioned to its size. This may be sufficient to produce some influence on

the tides in addition to what the sun produces; and if somewhat higher tides are known to rise in time of full moon, it is owing to the greater quantity of borrowed light, and consequently of her own electrical repulsion, which she then exerts on the earth's surface. Lower tides at the time of the moon's wanes may be owing to the less light and repulsion, which the moon then sends upon the earth. Tides are observed to be higher when the moon is in conjunction and opposition with regard to the sun; that is at new and full moon. And the reason is, that the moon when in conjunction with the sun assists the repulsion he exerts on the earth's surface by the addition of her own repulsion. On the other hand, at the time of full moon, or when she is in opposition to the sun, she exerts a greater electric repulsion upon the ocean on account of the greater quantity of light, as I said before, she then reflects to us, her sunny and more electrified side being then turned full upon the earth. Also when she is nearer the earth, she may exert a somewhat greater repulsion perhaps.

Pliny regarded the sun as being the principal cause of the tides.

ON ANIMATED NATURE.

THERE are other effects no less astonishing, which present themselves as we pursue the operations of this wonderful element. It is, indeed, sufficiently marvellous to behold it haling up the earth out of chaos, as it does a globule of water in the dust, and then binding her as with chains in a cohesive mass and directing her revolutions through the firmament. All this is wonderful; yet there are other phenomena which invest us on all sides, that are if possible, equally so, yet consistent with the effects already noticed. It is respecting the principle of animation in organic matter, or the kind of life inferior to soul.

Notwithstanding the obscurity in which it is said this principle is involved, yet regarding it as entirely distinct from mind, for intellectual or spiritual life is of a much higher order, I think it may be shown, that it is elementary fire only, which constitutes the vegetative life of plants and animals. Electricity and heat have each of them been supposed to constitute this principle. Oxygen also has been supposed to contain it; and each of these suppositions is in a measure true, it being fire only which constitutes electricity, heat, and the virtues of oxygen. And when we consider the wonderful power of fire on unorganized matter in exerting all its enlightening, moving, attracting, and repelling powers, whereby bodies on which it operates are quickly changed from the solid consistency of ice into the fine air, which whirls in eddies along the plains, and descending again in mists and dews are converted back into

ice and perhaps other solid substances, even passing from sap and blood into the firmest consistencies of plants and animals; when we consider all these metamorphosing agencies of this element on casual matter, can we doubt its ability to produce phenomena of life, when acting on the complicated organization of plants and animals? Indeed, the vivifying powers of the sun have long since obtained him the appellation of 'source of life,' an involuntary acknowledgment of the point we are endeavouring to establish, drawn out perforce by the universal and irresistible testimony of nature, which every where springs forth to meet him with smiles, and decks herself with gay and living garments, full of the freshness of vital energy.

To begin with the lowest order in animated nature, vegetation; take any plant, and we call that its principle of life, which is the immediate cause of its growth and germination. Seeds have a certain, mealy consistency, which causes them to swell, burst, and send forth a sprout on being cast into moist earth of a suitable warmth. They swell on account of imbibing moisture. This moisture enables the seed to receive a new quantity of the matter of heat from the earth, since fire enters moisture more readily than into any thing else, as appears from the sudden manner it quenches fire. From this early reception of heat through the medium of moisture, the seed begins to develop the first symptoms of life. This heat or caloric acts on the peculiar consistency and organization of the seed; in consequence of which, roots and sprouts are sent forth in opposite directions, the former to imbibe more moisture and heat, and the latter to ascend into daylight to meet and absorb the sunbeams by which they are in some measure attracted, as it appears from the turning of a blossom in a flower-pot on a window to meet the sun, and also from the disposition of the blossoms of the plant, called sunflower, in accordance to the direction of the solar rays. As sap in-

creases and enters into the growing composition of the vegetable, vital heat abounds, according to the quantity of the medium it exists in, and with which it enters into every part of the plant.

As the plant grows old, its sap diminishes, until at last it dies, and becomes a dry stalk. The increase, continuance, and abundance of its life accord with its quantity of sap; for when is it that it unfolds its flowers, and spreads out its leaves, and sheds its odours most plentifully? Is it not when sap abounds? The principle of life then is in the sap; but from whence does sap derive its active and surprising qualities? Is it not from the fire it contains? For when bereft of this, would it not become a mere sluggish, icy composition, void of all virtue? In autumn, when the frigidity of the earth puts a stop to the propagation of sap and heat, trees lose their leaves and their life escapes, but when spring draws nigh again, and new heat enters the earth, and dilutes her juices, so that sap may flow again, life returns. And so it is with those insects which lie dormant in winter; they need only a little heat to revive them and make them as lively as ever.

In ascending from vegetables to animals, life becomes more sprightly, as it is associated with more complicated and curious forms. The vivifying element then acts on nerves, muscles, tendons, joints, and all the curious mechanism of animal frames, and thus produces an infinite variety of motions, the most distinguishing of which from those of plants, is locomotion. But who would not have anticipated new and superior effects here in tracing the operations of this element on common and organic matter, until we arrive at the animal system? Sap then becomes blood, the vehicle of the animating substance. The juices which go to form blood, are not imbibed from the earth by means of roots, but from food by means of absorbing organs in the stomach, which imbibe juices from the food, that is swallowed in the same way as the roots of vegeta-

bles imbibe the same from the earth. Thus, the purpose of eating and drinking is to supply the body with those juices which form blood. Blood forms a capacious medium for animal heat, which must consist of the common matter of fire, that by means of this liquid medium, is diffused into every part of the body, constituting its principle of vegetive life.

But how does this fire get into blood? Whence is it this superior quantity of heat to that of surrounding bodies so constantly subsists? It is from that distinguishing faculty of animals, respiration. The lungs are of such peculiar and wonderful structure as to absorb into their moisture the matter of caloric out of the air, which enters them, however cold this air is. We have only to respire it in somewhat larger quantities, perhaps, when it is cold as in winter, than when it is warm as in summer. It has been said, (Phil. Trans. 1812), that respiration is not the cause of animal heat, because when carried on artificially in a decapitated animal, the heart can be made to retain its functions for only 'some hours,' after the head is taken away, and the animal cools down eventually to the atmospheric standard. This circumstance appears to be rather a proof of the reverse, since a mere artificial respiration is capable of sustaining the animal functions even to such an extent after the loss of so essential a member as the head. Would it not be analogous to assert, that an animal never had life, because it will not continue after the loss of its head, as to say that animal heat is not derived from air, because the lungs will not continue to absorb it after the loss of that chief, cooperating member with the whole animal system, the head? The head is the fountain of the whole nervous system, which is so essential to the animal functions; and consequently, when its cooperation with the lungs is withdrawn, could we expect that they would continue to imbibe the aerial fire as before? It is well known, that the oxygen of air is lost on its passing into the lungs. The peculiar virtue of oxygen consists of elementary fire; whence this vivifying element en-

ters the blood of the lungs, and constitutes vital heat. Warm-blooded animals consume the largest quantity of oxygen in respiration, which also shows, that this heat is acquired from air in the lungs. There is another objection to the production of animal heat by respiration, which may be stated here, as noticed by Franklin. (Let. on Phil. Subjects.) 'How a living animal,' says he, 'obtains its quantity of this fluid called fire, is a curious question. I have shown, that some bodies, as metals, have a power of attracting it stronger than others; and I have sometimes suspected, that a living body had some power of attracting out of the air or other bodies the heat is wanted. But when I consider that air in contact with the body cools it; that the surrounding air is rather heated by its contact with the body; that every breath of cooler air drawn in carries off a part of the body's heat, when it passes out again, I have been inclined to think, that there must be in the body a fund for producing it; otherwise, the animal would soon grow cold.' But it cannot be ascertained that the air we expire contains more caloric, than it did when entering the lungs. It does, indeed, feel warmer than it did before, but this is owing to its conversion into a more aqueous vapour. The air we expire is more aqueous than that we inspire; whence the caloric it contained before is more developed, and becomes more sensible. Thus, steam arising from boiling water may not burn the hand when held in it, yet if the same were suddenly condensed into globules or drops, even with a loss of a part of its former caloric, it may communicate a scalding heat. So the rarefied air we inspire, on being converted into a more aqueous vapour, may communicate a more sensible warmth to the touch, though after a loss of a part of its caloric. A stick of wood contains all the fire in a latent state, which it afterwards gives out on being burned.

Yet however animal heat is produced, it is certain, that it exists in the body, and knowing the activity, electrical influences, and exceedingly penetrating powers of fire, it may

easily be supposed to be able to produce the motions of living bodies, when acting on their complicated mechanism, preserving all parts in a flexible state, and being distributed through the different organs according to their density of matter or capacity for containing it. Hence it is probable, that it is this vivifying element alone, which produces all the motions of the human body in obedience to the mental will. When we wish to move any one of our limbs, some portion of this fire may move with a sort of electrical dispatch along the substance of the nerves into the muscular fibres, and thus imperceptibly effect the motions we desire. It is well known, that oftentimes when one is about to exert some great and sudden effort of corporeal strength, he inhales a large quantity or breath of air into his lungs; which seems to indicate a call for more fire into the body and nerves to produce the intended motion. Hence, it is possible for a man to be stronger or to exert a more violent motion of his limbs at one time than another, merely from a particular or uncommon vigour or impulse of mind, which may send more fire or a quicker motion of the same through his muscles in causing the motion. Muscular contraction may be caused by a retraction of fire from the fibres, and expansion by an opposite process.

The instantaneous and imperceptible manner, in which electricity will run along slender filaments, as a moistened thread, or into the hairs of the head of an insulated, electrified person, through a wire or other conducting substance, shows in some measure the ability of this element to traverse the nerves, muscles, and tendons of our bodies in producing their motions in obedience to the will. This is exemplified in the strongest manner by the application of Galvanic electricity to an animal recently killed, while yet flexible and retaining its heat; as also it has been employed for the recovery of persons recently drowned. In this case, the electric fire, on being sent through the muscles and limbs, produces all their former natural motions, and in the most active manner, so as to render the ani-

mal, to an ignorant beholder, apparently alive. The muscles of the face are made to move and contract so as to represent various contortions and expressions of countenance. The shock produced on being electrified is an instance also, of which many have had experience, of the wonderful ease and despatch, with which this substance can pass through our bodies. The pain is occasioned by the resistance the fluid meets with in passing through us. The shock is often felt in the elbows, which is probably owing to the crook or angle, which the fluid there meets with, if the arm be bent, in travelling along the tendons or bones.

The exhilaration which follows the drinking of spirituous liquors, or inhaling oxygen gas, is probably owing to the fire, which passes from those fluids into the brain and nerves; and is a further example of the ability of fire to produce animation. It is evident, that spirituous liquors contain much fire, from the easy manner they are set on fire, and the most spirituous of these, as alcohol, are most inflammable. These liquors may not contain more of the substance of fire, than water does, but have a far less capacity for it or ability to retain it, and are, therefore, more overcharged with it, and give it off more readily. It is evident also, that oxygen contains much fire according to its capacity for it, from the brilliant light which is developed by combustion in it, and since even metals may be burned in it, and also, since this gas when compressed becomes luminous.

The process of breathing appears to be a natural effect of the action of aerial fire on the muscular fibres which move the chest. Since it is the constant effect of fire to expand the bodies it enters; hence why should it not expand or relax these fibres, when received into them? And although the chest expands intermittingly, it is only in exact consonance with the intermitting quantities of fire, which it receives at every breath. A breath or quantity of air is inhaled into the lungs, and the fire absorbed from it enters the chest and other parts of the

body to supply the heat, which is constantly passing off in perspiration. This fire of a single breath on entering the organs which move the chest expands it, but immediately passing on to other parts of the body, the chest subsides again, but to be immediately expanded by the succeeding breath. The volume of air in the lungs, constantly increasing and diminishing on account of the change it undergoes there, may concur somewhat with the fire in producing this motion. The mechanism of the chest being connected with that of the heart, or constituting only parts of the same system, the motions or pulsations of the latter result from the motions of the former, in the same manner as the large wheel of a water-mill gives an impetus to a smaller one by the mechanism of cogs, which connect them; and thus the circulation of the blood and all the animal functions may be put in motion. Fire is the moving power.

All circumstances and the whole history of animal nature favour the existence or reality of this moving principle. When the animal dies, its heat departs with its life; and as it draws nearer to death from age or a general debility and decay, its vital heat is always diminishing as life grows weaker. But even in health, why is cold always painful, benumbing, and stupifying? Is it not, because a part of this animating principle leaves our flesh? Why is the fireside so pleasant and cheering? And why do we spread out our hands with joy before it? Is it not, because we then receive an accession of the same into our flesh? When is it that our bodies are fullest of life, are flexible, alert, and playful? Is it not in those periods of youth, when they are warmest and fullest of fire, and when we breathe and eat most heartily? And when is it, that we grow pale, or lean, or faint, or weak, or perish? Is it not, when our vital heat departs or decays, and breath refuses to replenish it? When too the mind begins to awaken its energies, and calls on the body to exert its strength and summon all its powers of life, does not air first rush into the lungs?

The chest begins to heave? The veins to swell? The eyes to sparkle? And the flesh to grow crimson for heat? Is it not then, when most fire is in the body, that it has the most of animal life?

In sacred history, we find the phrases, 'flesh with the life thereof, which is the blood thereof;' and 'your blood of your lives;' the blood receiving and containing vital heat and being a sort of vehicle of it. But blood divested of all heat would possess no virtues at all; hence, it must be for its distinguishing quality of heat, that it is said to constitute life. All living things on the earth, from the lowest species of vegetation to where they gradually ascend into reptiles and insects, fishes, birds, and quadrupeds, to man, the head of animals, all are imbued with certain juices calculated to imbibe fire into the body. And according to the quantity of these juices and animal heat, so is the activity of the creature or its degree of life. The more sluggish and imperfect, as fishes, reptiles, and plants, have least heat. Birds, quadrupeds, and men, are full of it. The egg of birds requires the heat of incubation to form the little animal which breaks from it.

The manner in which animal heat is extracted from air in respiration, I conceive to be very natural. Air is much more surcharged with fire than water is, as appears from the vastly greater ease with which it is burned. Hence a watery liquid, when exposed to air such as animals generally breathe, grows warm, and so much the quicker according to its quantity of surface in contact with the air. Now the peculiar characteristic of the lungs is the vast extent of surface, whereby its juices are exposed to the contact of inspired air; insomuch that it is said, 'every particle of blood must necessarily come in contact with a particle of air.' What then should follow but a great absorption of heat out of air? If an experiment could be made, wherein a similar extent of surface of a quantity of cold water was exposed to such a continual contact with fresh air, would not a similar heat be generated?

ON MATTER AND MOTION.

PERHAPS some of the ideas I have advanced may savour too much of antiquity for the liking of those who are prepossessed in favour of more recent notions on this subject. And it would, indeed, be singular, if physiologists, after all their labours and improvements in natural philosophy above the ancients, had yet to recur to them for instruction in one of its most important and fundamental principles. Yet these old words of Plato have yet a truth in them, which is able to cast much light on modern physics, and some reflection also on those who have so long and vainly endeavoured to darken them. "That fire and earth, water and air are bodies, is perspicuous to every one. The Fabricator of the world constituted it of fire, water, air, and earth. Fire and heat govern all other bodies—and inasmuch as they occasion warmth and cold, can effect the cohesion and dissolution of bodies, and perform all other things of this kind. The circulation then of the universe, since it comprehends the different sorts of things in its circumference, being of a circular form and desiring to pass into union with itself, compresses all things within its spacious receptacle, and does not suffer a void space any where to subsist. On this account, fire, in the most eminent degree, penetrates through all things, and air next to this, ranking as second to fire on account of the subtility and tenuity of its parts." (Dialogue of Timæus.)

Cicero observes of the ancient Platonists, "They divided nature into two parts, one of which was *active*, the other *pas-*

sive. They held it impossible for bodies to cohere, unless they were kept together by some force, and that it was necessary, that this force should be exerted by some matter." (Acad. Quest. lib. i.)

Fire 'disposes all things in the body,' says Hippocrates (De Diæta, p. 11), 'after a manner peculiar to itself and according to the similitude of the universe, so that small things are like to great and great to small; is most powerful, hath a universal dominion, and governs all things according to the order of nature, while itself is silent, invisible, and imperceptible in its operations, and in perpetual agitation.'

And what hinders, that we should not divide all matter into two kinds, the *active* and the *passive*? Fire constituting the former, and all other matter the latter? and thus account for the origin of motion on natural principles? In the present state of philosophy, it has been said, 'no natural principle accounts for the origin of motion. The origin of motion and of life is the same, God. We find ourselves living creatures; we find the bodies of the solar system in motion. Philosophy as readily accounts for one fact as the other. Both are beyond its reach.' But does not this savour of an imperfect state of philosophy? It is, indeed, very convenient for a physiologist when he finds himself unable to assign a natural cause for a thing, to refer it to the immediate agency of Deity, who is, indeed, the first cause of all things, not the second. But it may be well for those who are so religious as to carry about with them such a sense of the Divine agency, to consider whether it were not a degradation of Deity, an endless and unworthy task, an involving of infinite purity in dark and sluggish matter, if He were obliged to set his finger to every senseless body, the material cause of whose motions his frail creatures may not understand; and withal, to spare a thought upon that well known account of the first formation of matter, which we have in our sacred books. Chaos, which must have

contained the passive matter of our globe, lay in a dark, silent, motionless mass, called desolate waters; probably because it resembled water more nearly than any thing else we can conceive of, having never seen any portion of matter wholly destitute of fire, and consequently, being unable to conjecture what form it would then assume. But when 'the Spirit of the Elohim moved on the face of the waters,' what was the first command? And what did He then call into being, but that mighty agent, whereby He formed the earth out of chaos, and has ever since governed the material world? "Let there be light," said the Spirit. The Hebrew word for light (אוֹר) is rendered *fire* as well as light. Then, by this new agent, the element of *active* matter, the waters were gathered together at the divine command, and the dry land was made to appear, and all the other parts of creation were completed. And to supply this active element for its future operations, the Spirit set *lights* in the firmament 'to give *light* upon the earth.'

What could be clearer or more distinct? And what ingenious theorist could invent a material cause of motion so complete as this, which we have not only here revealed, but which is constantly recommended to our senses as being abundantly sufficient? Who then will say, that 'no natural principle accounts for the origin of motion?' Shall we compare Newton's ether to this? Or rather not wonder how any one could so shut his eyes against that which is even the cause of vision, and fills all space, and is most constantly visible, to labour after that which is so wholly needless, imaginary, and chimerical?

'And now we might add,' says he (Prin. Math. p. last,) 'something concerning a certain, most subtle spirit, which pervades, and lies hid in all gross bodies, by the force and action of which spirit, the particles of bodies mutually attract each other at near distances, and cohere if contiguous; and electric bodies operating to greater distances, as well repelling as

attracting the neighbouring corpuscles; and light is emitted, reflected, refracted, inflected, and heats bodies; and all sensation is excited, and the members of animal bodies move at the command of the will, viz. by the vibration of this spirit mutually propagated along the solid filaments of the nerves from the outward organs of sense to the brain, and from the brain into the muscles.' On the way it causes gravity, he says, (Newton on the Ether, p. 20) 'from the top of the air to the surface of the earth, and again from the surface of the earth to the centre thereof, the ether is insensibly finer and finer. Imagine now any body suspended in the air, or lying on the earth; and the ether being by the hypothesis grosser in the pores, which are in the upper parts of the body than in those which are in its lower parts, and that grosser ether being less apt to be lodged in those pores than the finer ether below, it will endeavour to get out and give way to the finer ether below, which cannot be without the bodies descending to make room above for it to go out into.'

Now how impossible is it, waving other considerations, that any fine ether or gas, for he says, it is 'much like air in all respects but far more subtile,' should be able to subsist constantly of the same degrees of rarity through all space, independent of the influences of heat and cold. Is not a mere gas the weakest and most inefficient of all substances? Whence then 'its great power and force derived from Diety, who by it governs the material world?' Will it bear a moment's comparison, after all that fiction can do for it, with the well known subtility, imperishable nature, extreme penetration, universal diffusion, and withering force of the active matter, fire? This is not free from all passiveness, however, as it appears from the reflection and refraction of light and the resistance, which electricity sometimes meets with, yet it is altogether distinct and superior to other matter, over which its excessive fineness enables it to exert its power by flowing through it in every direction,

whereby it may move a grosser substance by a tendency to carry it along in its currents. Yet we may not be able to understand, precisely, how all these physical effects are accomplished, or to comprehend all the susceptibilities of matter. It is not, however, more difficult to conceive of a degree of self-motion in the essence of fire, than of a natural capacity of mutual attraction in the parts of all matter, which not only amounts to a self-motion, but extends this property much further, than if confined to one element.

But however this may be, far be it from us to erect a material element, sublime and subtle as it may be, into any sort of spirituality, any thing like a first cause or prime mover, any thing of that worshipful character so common to heathen antiquity, although it may aptly supply the place of a fancied, etherial medium, plastic nature, subtle matter, or even a sort of *anima mundi;* and although even Newton has discovered a mysterious affinity between his 'subtle Spirit' and his literally omnipresent Deity described in context on the concluding pages of his Principia. Our Sunday still retains the name it appears to have derived from the sun's worship among our pagan forefathers; and although the fire and sun worshippers may have generally regarded this element as an adorable emblem of Deity rather than Deity himself, yet it appears, that a degree of intelligence, at least, was sometimes attributed to it, if, indeed, we may understand literally certain expressions from the Oracles of Zoroaster, (in Stanley's Lives of Phil.) such as, "intelligent fire, life-giving fire—splendid fire, the soul of the father, remaining immortal, and the Lord of life,"—whatever may have been the nature of the Empyrean fire, or what was sometimes supposed to be a sort of atmosphere in heaven, which the tenants of that happy place breathed as men do air, or what shone from thence in the stars, as if these were merely so many apertures in the crystal vault of the spheres, that in their various revolutions rolled on one another in harmonious music.

As to the essence of matter, it may be, for aught we know, as early in origin and eternal in duration, as spirit. It was the common doctrine of antiquity, that matter is in itself eternal, and that nothing can arise from nothing. Nor, perhaps, is revelation so averse to this original tenet, as many suppose. The earth was created out of the matter or waters of chaos; nor does a final destruction by fire imply annihilation or more than a natural decomposition. Neither may the original terms of, 'to generate,' 'create,' or 'make,' imply of necessity a production out of absolute nothing, or can such a thing, if true, be at all intelligible to the human mind, either from analogy or any effort of the imagination. All being may be necessarily eternal, however changeable. But whatever may have been the state of things before creation, a real pantheism is virtually held to, oftentimes by the stoutest bigotry; as in a literal omnipresence of Deity, and a particular and preserving providence, which refers all existence and material motion to his continued and immediate agency. So Newton. (Principia, Con.) Deity "is omnipresent, not virtually only, but also substantially, for virtue cannot subsist without substance. In him are all things contained and moved, yet neither affects the other. God suffers nothing from the motion of bodies; bodies find no resistance from the omnipresence of God. —He exists necessarily; and by the same necessity, he exists always and every where—thus much concerning God, the discovery of whom from the appearance of things does certainly belong to natural philosophy." But only admitting a substantial omnipresence and a preserving providence of Deity, which immediately extends to all events, and how does this differ from the world itself considered as a sort of machine or huge animal, or from a soul of the universe, actuating all its motions and forming one being with it, as the soul and body form man? "There is a common notion in the world," says Bishop Burnet, (Ex. 39 Art. 1.) "that things would fall back into nothing of themselves, if they were not preserved by the same infinite Power, that made them. But—there is no more reason to imagine, that beings

have a tendency to annihilation, than that nothing had a tendency to creation. It is absurd to think, that any thing can have a tendency to what is essentially opposite to itself and destructive of it.—Some make God to be the first and immediate cause of every action or motion.—To others all this seems first unnecessary, for if God has made matter capable of motion and of receiving it from the impulse of another piece of matter, this comes as truly from God, as if he did immediately give every motion by an act of his own will. It seems more suitable to the beauty of his workmanship to think, that he so formed things, that they hold on in the course, in which he has put them, than to make him perpetually produce every new motion." The doctrine of revelation is, that Deity is the presiding Spirit of the universe, whose residence is in heaven; whence the system of angels or messengers to go on his errands, and to speak in His name. "No one," says Justin Martyr, (Cum. Trypho,) "of the slenderest understanding would venture to say, that the Author and Father of the universe left his heavenly abode to show himself in a corner of the earth. He alone, who is called an angel and is God, appeared and conversed with Moses." So in the Orphic Remains—(Elton's Spec.)

> "Himself above the firmament's broad arch
> Sits on a throne of gold. The round earth lies
> Below his feet."

GRADATION FROM MATTER TO SPIRIT.

In the gradation of material being, we may ascend by these steps; earth, water, air, fire; or from the grosser parts of more passive matter, the lower rank in the scale of being, to the sublimer parts of more active matter; and ascending still higher, although the gradation, for aught we know, may be imperceptible, no purity of fire may equal the lowest order of spiritual being. (By figure, however, the term, *spirituous*, is applied to this substance, as in spirituous liquors, called by the Indians, *fire-water*.) Nor, perhaps, may pneumatology be too far debased by this proximity of matter, but receive much confirmation by means of that analogy, which is so necessary in order to bring home truth to the understanding; for how striking the resemblance between the indwelling and moving agency of active in passive matter, and the soul within the body. Observe an electrified piece of matter; what apparent life is given it by the electric fire with which it is impregnated; how similar to a sort of transitory soul. Indeed, this element of the sun, penetrating every portion of the material universe with the extensive agency we have been considering, may well be called, at least by figure, a soul of the world; the soul of unorganized matter.

But in ascending to the lowest order of more literal animation, we dare not say, that it is this element only, which constitutes the vital principle in plants; there is such a diversity here from any electrification of unorganized matter, or any crystallization in mineralogy. Plants may be figuratively called a sort of animals. Like animals, they are born or hatched from a kind of egg incubated by the sun; they live, grow, attain specific forms, have

clothing, which they statedly shed, decay as by age, and die. Their blood is called sap, and circulates in a system of arteries and veins; they consume food or nutriment from the earth, perspire, respire, produce seed, or lay eggs, which, like those of various animals, are left to hatch of their own accord in earth or water. Some plants grow pale in the shade, sleep by night, possess a species of sensibility, locomotion, and sexual diversity; and finally ascend into the animal kingdom, as through the polypus, by a gradation almost imperceptible. But who in these days will deny, that animals have a sort of soul? and where shall we draw the line betwixt it, and the vital principle in plants? Or what mechanism, or what phenomena in mere matter, will at all account for these appearances?

"What now is this wonderful principle," says Dr. Good, (Lec. 1, Ser. 3,) "that so strikingly separates organized from inorganized matter? that from the first moment it begins to act, infuses energy into the lifeless clod, draws forth form, and order, and individual being from unshapen matter, and stamps with organization and beauty the common dust we tread upon? I have called it an agent or endowment:—is it a distinct essence? and if so, is this essence refined, etherialized matter, freed from the more obvious properties of grosser matter; or is it strictly immaterial? It has been said by different physiologists to be oxygen, caloric, the electric or galvanic gas; but all this is mere conjecture, and even of several of these powers we know almost as little as we do of the vital principle itself, and are incapable of tracing them in the vegetable system." It was an ancient opinion, sometimes maintained also in modern times, that there is a sort of vegetable soul. So Aristotle, (De plantis, lib. 1, chap. 1.) "Life is found both in animals and plants. In animals, it is obvious and indubitable; but in plants, more occult and inevident. —Yet surely it is not certain that plants may not have a soul, and a faculty of desire, of pain, of pleasure, and of a sort of discernment. Anaxagoras and Empedocles say, that they are influenced by desire, and affirm, that they perceive, and are affected with dejection and delight. Indeed, Anaxagoras taught, that

they were really a sort of animals, moved by pleasure and pain; so judging from the power of growth and the fall of the leaf. But Empedocles attributed sex to them. And Plato affirmed, that they were impelled by appetite solely to a vehement necessity of the faculty of production.—Some affirm, that plants have souls, because they generate, grow, and bloom, as it were in a period of youth, and again wax old, and decay as in age.—We however assert, that plants have neither desire nor sense.—Yet plants are not of the number of those things, that are destitute of soul. —Again, we are able to say, that plants have souls, since this is the cause of motion in them." In another place (De anima, lib. 3, c. 12,) he says, that "it is not necessary that sense should exist in all that lives." But although such doctine of this great master of learning may appear somewhat surprising to many at the present day, yet some of the most eminent botanists of even late years have gone further on this point than Aristotle, that is, in ascribing sensibility to plants. See for instance the observations of Smith in the introductory part of his botanical system;— "Linnæus enumerates 46 flowers which possess a sort of sensibility"—(Phil. in Sport, Note 1,) besides what has been so extensively said in modern times on the sexual and hermaphrodite theory. We find, moreover, certain remarkable references of this kind in even savage life, where we can hardly look for any of that philosophical speculation, which is not founded on sense or some of the more obvious principles of our nature. Among the Otaheitans, for instance; "they maintain," says the voyager, Cook, (v. 2. B. 3, c. 9,) "that not only other animals, but trees, fruit, and even stones have souls, which at death or upon being consumed or broken ascend to the divinity, with whom they first mix, and afterwards pass into the mansion allotted to each." Nor may this allusion to even stones, or the primitive formations of geology, appear altogether unaccountable, if we consider the almost imperceptible gradation of vegetative life through the funguses and corals into crystallization and that enlivening element, which acts as soul to even the huge body of the earth itself. The moss upon the stone is not so very differ-

ent from the mineral itself or that magnetic ore, which is so powerfully imbued with a moving power.

But whatever sort of electrical or other mysterious process may be concerned in crystallization and geological formations, and whatever be this more essential principle of vegetative life, the latter appears to be something more than is immediately concerned in the former; something more than mere matter, although it may not arise in the scale of being to what we commonly understand by soul and sensation. And if all this may be said of plants and insensible being, who will deny, that any species of animals have a sort of soul? Who in these days will cling to the Cartesian absurdity, and hold that brutes are mere insensate machines? and with the Abbe Polignac, (Anti-Lucretius) gravely maintain, "that the hound has no more will of his own in chasing the fox, than the wires of a harpsichord have in exciting tones, and that as the harpsichord is mechanically thrown into action by a pressure of the fingers upon its keys, so the hound is mechanically urged onwards by a pressure of the stimulating odour, that exhales from the body of the fox, upon his nostrils." Who in these days will so run in the current of infidelity and direct opposition to the existence of such a thing as the human soul, by denying a species of this existence in inferior animals, when every argument, which can oppose the one doctrine, will equally resist the other? For are they not animals as well as we, displaying a similar anatomy? Have they not all our five senses, all our external affections of mind, and often to a far greater extent of sensibility than in ourselves? Have they not also all our more ordinary internal affections of mind, such as will, instinct, emotion, anger, fear, desire, pleasure, grief, memory, association of ideas? and oftentimes a degree of understanding, reason, conjugal propensity, and social attachment? Vain man, to suppose that no body else can have a soul because he has one —the earth made for him alone—

——— "all things for his use—
See man for mine, replies the pampered goose."

If certain, remoter, and sublimer, intellectual, sentimental, or religious affections of mind are going to constitute the essence of all spirit, supposing superior spirits, as angels, were to annihilate us, because we may not equal them in these affections—might they not or even one more gifted man annihilate another, if they meted unto us such measure as we mete unto others?

But how to dispose of this inferior gradation of soul at death has been a stumbling-block with some, as if speculation about the future state were to dictate the evidence of sense, or, out of the body, there might not be any place of spiritual existence but in heaven or hell, whither it may not be well to carry brutes along with us—no outer courts about the holy of holies, but an abrupt descent into the valley of Gehenna—but who has told us, that the essence of spirit consists in moral accountability, or a specific condition in the future state? or that there may not be any order of superior spirits, unless they be accountable beings just as we are, and bound to hell or heaven? But although these distant considerations may have little to do with our more immediate subject, yet as a matter of curiosity, we will conclude with a quotation from Aristotle, however true or heathenish it may be. (De divina sapientia Egyptorum, lib. 2, c. 3.) "Active intellect is never separated from the soul.—Whence the mind is ever in operation, because it forever exists: and notwithstanding those souls, which are in other animals, as the lion for instance, may have fallen by sin from a superior world, yet they perish not in their substance but in affections only. Thus, they do not perish utterly, but return to a superior world. The affections, indeed, of the inferior world are diverse from the soul itself; yet accommodated to the animal nature; if, indeed, they proceed from the same. And in a similar manner, the souls of plants also derive their origin from the same source, and when they come into life are substances, not affections, or destitute of corporeity; not partible, or by any means liable to annihilation. But the human soul has three faculties, the vegetable, animal, and intellectual; a distinction which is dissolved at the dissolution of the body."

PRESENT STATE OF MENTAL PHILOSOPHY.

We come now to treat of the soul, properly so called; that is, the human soul, embraced in the subject of Metaphysics and Intellectual Philosophy. In view of the present state of this science, it is generally observed, that, "If the physical sciences have received great improvements during the last century, it is feared the same cannot be said respecting the science of the human mind and the auxiliary branches of philosophy—and there are serious grounds of suspicion, that many modern systems of high claims and imposing aspect are by no means substantial additions to the sum of knowledge.—It is a curious fact, that while a much more simple and intelligible philosophy of mind has in the course of the last age taken the place of former, perplexed, and abstruse systems, yet the study of metaphysics, through the whole of the age, has been almost uniformly declining in popularity.—Hence the word, *metaphysics*, is seldom pronounced but with contempt, as signifying something useless, unintelligible, or absurd." (Miller's Retrospect, vol. ii. c. 12.)

So little point or tangibility is there in the prevailing Cartesian system, built, so far as upon any thing, on the speculative foundation of Cogito. If we even follow up the subject to the fountain-head, to whatever is premised respecting the existence of the mind itself as denoting all that is spiritual in man, how little can we find to get hold of. "It is not matter or body," says Stewart, (Elements Phil. Human Mind, vol. i. Int.) "which I perceive by my senses, but only extension, figure, colour, and certain other qualities, which the constitution of my nature leads me

to refer to something, which is extended, figured, and coloured. The case is precisely similar with respect to mind. We are not immediately conscious of its existence, but we are conscious of sensation, thought, and volition; operations, which imply the existence of something, which feels, thinks, and wills.—Whether it be extended or unextended, whether or not it has any relation to place, are questions, of which it is unnecessary to inquire."—So Brown also. (Lectures Phil. Mind, Lec. 9.) "If our knowledge of matter be relative only, our knowledge of mind is equally so.—Of the essence of the mind we know nothing, but in relation to the states or feelings, which form, or have formed our momentary consciousness.—We define it therefore, by stating its various susceptibilities." Locke is somewhat clearer. (Essay on Un. B. 2, c. 23.) "If any one will examine himself concerning his notion of pure substance in general, he will find he has no other idea of it at all, but only a supposition of he knows not what support of such qualities, which are capable of producing simple ideas in us; which qualities are commonly called accidents. If any one should be asked, what is the subject wherein colour or weight inheres, he would have nothing to say but the solid extended parts; and if he were demanded what is it, that solidity and extension adhere in, he would not be in a much better case than the Indian, who, saying that the world was supported by a great elephant, was asked what the elephant rested on, to which his answer was, a great tortoise. But being again pressed to know what gave support to the broad-backed tortoise, replied, something. And thus here as in all other cases, where we use words without having clear and distinct ideas, we talk like children, who, being questioned what such a thing is, which they know not, readily give this satisfactory answer, that it is something; which, in truth, signifies no more when so used either by children or men, but that they know not what, and that the thing they pretend to know, and talk of, is what they have no distinct idea of at all, and so are perfectly ignorant of it and in the dark.—The same thing happens concerning the operations

of the mind, *viz.* thinking, reasoning, fearing, &c., which we, concluding not to subsist of themselves, nor apprehending how they can belong to any body, or be produced by it, we are apt to think them the actions of some other substance, which we call spirit—and, therefore, from our not having any notion of the substance of spirit"—but it is enough. By their own confessions, all substance or real existence, whether of matter or spirit, has no place in human knowledge, and no better foundation than that of the Indian tortoise, fabled to support an elephant, which bore up the world. And what more could skepticism or infidelity desire? What wonder, that so little is said of a soul in inferior animals, when it is so hardly allowed any existence in even man or any where else?

But Dr. Reid gives us a still further account of this subject, its history, and tendency, with an ingenuous perspicuity somewhat rare in such matters. (Inquiry into the Mind, chap. 7.) "How generally men of all nations and in all ages of the world have conceived the soul or thinking principle in man to be some subtle matter, like breath or wind, the names given to it in almost all languages sufficiently testify.—It does not appear, that the notions of the ancient philosophers with regard to the nature of the soul were much more refined than those of the vulgar, or that they were formed in any other way. We shall distinguish the philosophy, that regards our subject, into the old and *the new.* The old reached down to Descartes, who gave it a fatal blow, of which it has been gradually expiring ever since, and is now almost extinct. Descartes is the father of the new philosophy, that relates to this subject; but it hath been gradually improving since his time, upon the principles laid down by him. The old philosophy seems to have been *purely analogical;* the new is more derived from reflection, but still with a very considerable mixture of the old analogical notions.—The system, which is now generally received with regard to the mind and its operations, derives not only its spirit from Descartes, but its fundamental principles; and after all the improvements made by Mal-

lebranche, Locke, Berkeley, and *Hume*, may still be called *the Cartesian system;* we shall therefore make some remarks upon its spirit and tendency in general.—

"I.—*Intending to build a system upon a new foundation*, Descartes began with a resolution to admit nothing but what was absolutely certain and evident.—In this method of proceeding, what appeared to him first of all certain and evident was, That he thought, that he doubted, that he deliberated. In a word, the operations of his own mind, of which he was conscious, must be real and no delusion.—This, therefore, he looked upon as the first of all truths. This was the first firm ground, upon which he set his foot after *being tossed in the ocean of skepticism;* and he resolved to build all knowledge upon it, without seeking after any more first principles. Every other truth, therefore, and particularly the existence of the objects of sense, was to be deduced by a train of strict argumentation from what he knew by consciousness.—It was *not in the way of analogy* but of attentive reflection, that he was led to observe, That thought, volition, remembrance, and the other attributes of the mind are altogether unlike to extension, to figure, and to all the attributes of body; that we have no reason therefore to conceive thinking substances to have any resemblance to extended substances; and that as the attributes of the thinking substance are things, of which we are conscious, we may have a more certain and immediate knowledge of them by reflection, than we can have of external objects of sense. These observations, as far as I know, were *first made* by *Descartes;* and they are of more importance, and throw more light upon the subject, than all that had been said upon it before. They ought to make us diffident and jealous of every notion concerning the mind and its operations, which is drawn from sensible objects in the way of analogy, and to make us rely only upon accurate reflection as the source of all our real knowledge upon this subject.

"II.—The Peripatetic, taking it for granted, that bodies and their qualities do really exist, and are such as we commonly take

them to be, inferred from them the nature of his sensations, and reasoned in this manner: Our sensations are the impressions, which sensible objects make upon the mind, and may be compared to the impression of a seal upon wax; the impression is the image or form of the seal without the matter of it; in like manner, every sensation is the image or form of some sensible quality of the object. This is the reasoning of Aristotle, and it has an evident tendency to materialize the mind and its sensations. The Cartesian, on the contrary, thinks, that the existence of body or of any of its qualities is not to be taken as a first principle.—Hence, Descartes and Locke inferred, that sound, taste, smell, colour, heat, cold, which the vulgar took to be qualities of body, were not qualities of body, but mere sensations of the mind. Afterwards, the ingenious Berkeley, considering more attentively the nature of sensation in general, discovered and demonstrated, that no sensation whatever could possibly resemble any quality of an insentient being, such as body is supposed to be.—Thus, by just reasoning upon the Cartesian principles, matter was stript of all its qualities; the new system, by a kind of metaphysical sublimation, converted all the qualities of matter into sensations, and spiritualized body, as the old had materialized spirit.—

"III.—I observe, That THE MODERN SKEPTICISM IS THE NATURAL ISSUE OF THE NEW SYSTEM; and that, although it did not bring forth this monster until the year 1739, it may be said to have carried it in its womb from the beginning. The old system admitted all the principles of *common sense* as *first principles*, without requiring any proof of them, and therefore, though its reasoning was commonly vague, *analogical*, and dark, yet it was built on a *broad foundation*, and had *no tendency to skepticism*. We do not find, that any Peripatetic thought it incumbent upon him to prove the existence of a material world; but every writer upon the Cartesian system attempted this, until Berkeley clearly demonstrated the futility of their arguments; and thence conluded, that there was no such thing as a material world; and that the belief of it ought to be rejected as a vulgar error.—That the

natural issue of this system is skepticism, with regard to every thing except the existence of our ideas and of their necessary relations, which appear upon comparing them, is evident: for ideas being the only objects of thought, and having no existence but when we are conscious of them, it necessarily follows, that there is *no object of our thought*, which can have a continued and *permanent existence*. Body and spirit, cause and effect, time and space, to which we were wont to ascribe an existence independent of our thought, are all turned out of existence by this short dilemma: Either these things are ideas of sensation or reflection, or they are not: if they are ideas of sensation or reflection, they can have no existence but when we are conscious of them; if they are not ideas of sensation or reflection, they are words without any meaning. Neither Descartes nor Locke perceived this consequence of their system concerning ideas. Bishop Berkeley was the first who discovered it. And what followed upon this discovery?—Why, with regard to the material world, and with regard to space and time, he admits the consequence. That these things are mere ideas, and have no existence but in our minds; but with regard to the existence of spirits or minds, he does not admit the consequence; and if he had admitted it, he must have been an absolute skeptic. But how does he evade this consequence with regard to the existence of spirits? The expedient, which the good Bishop uses on this occasion, is very remarkable, and shows his great aversion to skepticism. He maintains, that we have no ideas of spirits; and that we can think, and speak, and reason about them and about their attributes without having any ideas of them. If this is so, my Lord, what should hinder us from thinking and reasoning about bodies and their qualities without having ideas of them? The Bishop either did not think of this question, or did not think fit to give any answer to it. However, we may observe, that in order to avoid skepticism, he fairly starts out of the Cartesian system, without giving any reason, why he did so in this instance and in no other. This, indeed, is the only instance of a deviation from

Cartesian principles, which I have met with in the successors of Descartes; and it seems to have been only a sudden start, occasioned by the terror of skepticism; for in all other things, Berkeley's system is founded upon Cartesian principles. Thus we see, that Descartes and Locke take the *road that leads to skepticism*, without knowing the end of it; but they stop short for want of light to carry them further. Berkeley, frightened at the appearance of the dreadful abyss, starts aside, and avoids it. But the Author of the Treatise of Human Nature, [that is, Hume, 1739] more daring and intrepid, without turning aside to the right hand or to the left, like Virgil's Alecto, shoots directly into the gulf:"

> Hic specus horrendum, et sævi spiracula Ditis
> Monstrantur: ruptoque ingens Acheronte vorago
> Pestiferas aperit fauces.

Thus, ingenuously, Dr. Reid, the greatest ornament perhaps of Cartesianism or modern metaphysics, although he made some vain efforts to innovate upon it, or reconcile the system to common sense; and such, at best, is the acknowledged termination of this course—broad is *the road that leadeth to destruction*, and many there be that go in thereat—yet out of their own mouths and by their own words, how easily may they be confuted. Nor is it by a train of deduction only that these consequences may follow. The first principles of the system are those only of infidelity; for the moment, that the principle, Cogito, is admitted, or any internal consciousness, which casts all our knowledge of material or spiritual entity into mere quality, from essence to quality, that moment is the entity itself denied, for it is a maxim, which cannot be disputed, that no mere quality, or attribute, or thought, or sensation, or feeling has any distinct existence from the subject or substance to which it belongs, or of which it is predicated. So true is the remark of the celebrated Liebnitz, that Spinozism is only an overstrained Cartesianism, "un Cartesianisme outré." (Maclaurin's Dis. of Newton, B. 1, c. 4.) In fact, our prevailing systems of intellectual philosophy are singularly accommodated to Materialism, and have only a few merely nominal or

unintelligible phrases, which custom will not yet suffer to be laid wholly aside, that are at all offensive to the materialist. Locke does, indeed, insinuate in his skeptical way, and against all evidence or discrimination, that there may be a nominal essence or attribute subsisting distinctly from any subject; (Es. Un. sect. on Essences;) yet he also admits, that matter may think, and his testimony on this head is adduced by Priestley in support of Materialism. (On Mat. & Spir.)

However, in this artful ambages to pave the way to skepticism, great repugnance is pretended to any assimilation of mind with matter, as though there were an *utter dissimilitude* between all faculties of the mind, all *ideas of sense*, and those material objects, of which they are the *express representation*, (ιδεα) and with which, they are in fact completely identified, when all our knowledge of matter and even *matter itself*, or its only existence, is said to *consist in these ideas* alone! while at the same time, the least analogy between mind or ideas and those objects of sense, from which alone they are derived, is pretended to be a gross materializing of spirit, even as if, in respect to the Supreme spirit, it were a grand source of idolatry and the setting up of some graven image of Him! So full of inconsistency and contradiction is this scheme; while the principle, Cogito, will give the same sanction to every exercise of mind, every fancy, every dream, every freak of hallucination or insanity, as it will to the correctest reasoning, for both are built upon the same basis! yet what do we hear of the phenomena of dreaming, lunacy, and all the more remarkable affections of the mind, in these systems? Nothing; for fear of a claim to reality.

That the Cartesians have done whatever they possibly could to annihilate all distinct entity or substance in soul, and thus open the way to materialism, is the more evident from the words of Hume, who, as we have seen, is reckoned among the greatest proficients in the sect. (Treatise on Human Nature, Part 4, Sec. 5.) "I have condemned that question," says he, "concerning the substance of the soul, as utterly unintelligible; yet I

cannot forbear proposing some further reflections concerning it. I assert that the doctrine of the immateriality, simplicity, and indivisibility of a thinking substance is a true atheism, and will serve to justify all those sentiments, for which Spinoza is so universally infamous—to whatever side we turn, the same difficulties meet us, and we cannot advance one step towards establishing the simplicity and immateriality of the soul without preparing the way for a dangerous and irrecoverable atheism,—we have *no idea of a being endowed with any power*, much less of *one* endowed with *infinite power*.—To pronounce then the final decision upon the whole; the question concerning the substance of the soul is absolutely unintelligible." So says Brown also—(Lec. 9.) "Of the essence of mind we know nothing—"

Dr. Priestley shows, more at large, how Cartesianism has introduced materialism. (Controversy with Price, p. 265), "The idea of the soul being immaterial soon led to the idea of its not having any property in common with gross matter, and in time, with matter strictly considered, and being confounded with, and illustrated by, the idea of the principle of life, it was asserted to have no length, breadth, or thickness, which are properties peculiar to matter; to be indivisible also, and finally not to exist in space.—Various other refinements occur in the writings of the schoolmen upon the subject. But the doctrine of pure spiritualism was not firmly established before Descartes, who, considering extension as the essence of matter, made the want of extension the distinguishing property of mind or spirit. Upon this idea, was built the immaterial system, or this system in its state of greatest refinement; when the soul was defined to be immaterial, indivisible, indiscerptible, unextended, and to have nothing to do with locality or motion, but to be a substance possessed of the simple powers of thought and to have nothing more than an arbitrary connexion with an organized system of matter. This was the idea of mind or spirit, which was prevalent about the time of Mr. Locke, who contributed greatly to lower it, by contending, that whatever exists must exist somewhere or in some place,

and by showing, that, for anything we know to the contrary, the power of thought may be superadded by the divine Being to an organized system of mere matter, though at the same time declaring himself in favor of the notion of a separate soul. From this time, the doctrine of the nature of the soul has been fluctuating and various; some still maintaining, that it has no property whatever in common with matter, and bears no relation to space, whereas others say, that it exists, and occupies a portion of it so as to be properly extended, but not to have solidity, which they make to be the property that distinguishes it from matter. The object of my late work is to prove, that the doctrine of a soul is altogether unphilosophical—and that the refined and proper spiritualism above described is peculiarly chimerical and absurd." And in another place—(On matter and Spirit, p. 216,)—"The strict, metaphysical notion of immateriality is really a modern thing, being unknown to all the wise ancients, whether heathen or Christian.—It is no article in Christian faith, but *really an upstart-thing* and a nonentity."

Dr. Good also observes on this point, (Book Nat. Lec. 1, S. 3.) that "Opposed as the two hypotheses of materialism and immaterialism are to each other, in the sense in which they are commonly understood, it is curious to observe, how directly and equally they tend to one common result, with respect to a point, upon which they are conceived to differ diametrically; I mean an assimilation of the human soul to that of brutes.—The immaterialist, however, on the approach of dissolution, finds one difficulty peculiar to himself, for he knows not at that period how to dispose of the brutal soul: he cannot destroy an incorruptible substance, and yet he cannot bring himself to a belief, that it is immortal." But the proper Cartesian, here, if possible, more than falls in with the materialist, or opens the widest door to him, by holding, that inferior animals, so far from consisting of any thing more than matter, are mere machines, and have no sense.

ON THE EXTENSION OR CORPOREITY OF SPIRIT.

But for all these lamentable results of individual speculation, this widening of a gulf between matter and spirit, till no shore on the latter side can be any longer found, this refining till every thing is refined away, and all for an alleged fear of materializing spirit, this running of hypocrisy and bigotry into real infidelity, this falling on Scylla to avoid Charybdis, still there remains a lingering semblance of the truth, to which it may be well to "give heed as to a light shining in a dark place;" still there is a twig, on which the drowning man may seize. It is not, however, the light of Christianity, to which we here refer in particular, as if to a last resource in days of extremity, although this must ever be the final support, when the sky of learning is obscured with clouds, the constant magnet, which is to direct our course on the ocean of time to the land of eternity. Mind or spirit has still at least a nominal existence in the schools; it is still called a substance, although such a kind of substance as can have no real existence.

Hume, says Dr. Reid, (Inq. c. 7,) endeavoured to prove, "That the mind either is no substance, or that it is an extended and divisible substance.—I confess, I think his reasoning in this as in most cases is clear and strong—[yet]—On the contrary, I take it for granted, upon the testimony of common sense, that my mind is a substance; that is, a permanent subject of thought; and my reason convinces me, that it is an *unextended* and indivisible substance; and hence I infer, that there cannot be in it

any thing that resembles extension." Thus we perceive, that the substance or existence of mind, is taken by the Cartesians as a gratuitous assumption, and that the objection of the Materialists on this head (Ed. Rev. Jan. 1804) is just. If, indeed, the substance of mind or spirit has *no extension*, it can fill *no space*, or be in *any place*, or *any where*. Where then is its existence? or *how could nothing be defined more explicitly?* If we set about to define nothing, or that which does not exist, in the most accurate and distinct manner, it is impossible to do it better, than by saying it is that, which is no where, in no place. Let any one make the effort. This fact is so startling, and schoolmen are so loath to be thought infidels, that it is still a question given to sophister-students for forensic disputation, "Do spirits occupy space?" and, however inconsistent with other principles, it is also even said, that the mind or soul is seated in the brain, (which, by the way, extends in the nerves to every part of the body,) although this may be true, and the substance of mind be only a part of the brain itself, as forsooth it must be, if we come to any meaning in asserting the essence of the soul to consist in a mere quality, that of thinking, and still say, that this quality or nominal essence is seated in the brain; for what is it more than saying, that mind or thought is a quality of the brain? So completely does Cartesianism accommodate itself to Materialism.

But if spirit has any extension, and subsists distinct from matter, it must fill some space, be in some place, have some dimension, form, or corporeity. Hence, if spirit have not some corporeity, it is nothing; no substance more than what is merely nominal, or a mere quality. Professor Brown himself has written a treatise to show, (if indeed so much meaning may be given to the work), that no mere quality or attribute, such as *power*, for instance, can have a distinct subsistence, although an almost self-evident fact; and although it were needless to pretend, that a merely nominal essence, as the word *power* denotes, ought to be expunged from language, while it need only be held, that no word, denoting a mere quality or nominal essence, should be

ever used, or has ever any meaning except in conjunction with some substantial subject either expressed or understood. The soul is often called a mere principle, thinking *power*, or some other such attribute. Deity is also spoken of as consisting only in certain attributes, or being an infinite *power*—power of what?—the visible universe? as mind or thought were a *power* of the brain?

But much of this sophistry, much of the infidel objection, urged, as in some of our preceding quotations, against the immateriality of spirit, has proceeded from a Cartesian assumption in respect to the essence of matter, as gratuitous, speculative, and presumptuous, as that respecting the essence of spirit. We refer to a violent thrusting of this *essence* from all substance or distinct existence into a mere quality, that of EXTENSION; as the *essence* of spirit is thrust from all real substance into the quality of *thinking*. Hence, whatever is extended, or really exists, has been gratuitously supposed to be material, divisible, discerptible, and what not. But even with respect to the primitive parts of matter, who can show, that they are divisible or mortal, and on this analogy, that a soul might not exist even of matter, and still be indestructible? How absurd then to gratuitously assume, that there may not be any superior kind of being, (called *immaterial* for not partaking of the more ordinary or characteristic qualities of matter,) and still be uncompounded in essence, and consequently, immortal. Matter, or its *essence*, consists in *what we perceive by our senses*, our five senses; yet who can show, that spirit, or its essence, is so unlike matter in every respect, so insecure in existence for lack of *all analogy* to inferior being, or the source of human knowledge, that in all ages and countries it may not have been sometimes perceived by some of these senses, as that of vision?

Nor has the Cartesian sect, or the individual speculation of a skeptical Frenchman, run away with all the modern learning, which relates to this subject, or perhaps with whatever of it has any thing to do with intelligibility or certainty; however mightily

it may have prevailed. Nor has it assumed an entire sway over general literature or popular prepossession, so strong are these principles in the constitution of our being, so buoyant is nature; as well might the terrors of Etna be restrained in its crater by the hand of a child. Still, in all general and popular literature, as it ever has been in all ages, spirit is spoken of as a distinct subsistence, and having corporeity. The ghost story is still a tale of popularity, a tale of horror, a tale of romance. The ghost in Hamlet and Macbeth still impresses the veriest worldlings, in the veriest haunts of sensuality. Nor is it, perhaps, often imagined, how far that simple and frequently ridiculed question, "Do you believe in ghosts?" may constitute a test of faith in spiritual existence, of faith in Christianity, that faith, which lingers on "the evidence of things not seen;" whatever be the pretences of hypocrisy. This peculiar synonyme with spirit has, indeed, grown oldfashioned in the schools, and, as if this sort of existence had for a long time been gradually wearing away from spirits of a lower order, as in inferior animals, upward in the scale of being towards the Supreme Spirit of all, we now seldom hear of any ghost in the desk of doctrine but the Holy Ghost, which being so often identified with the Most High himself, it would seem, that His existence must not be wholly denied quite yet.

It is not necessary, however, that, because soul or spirit has a real existence and extension, it should be of an unvarying, or even a determinable form. We contend for the entity alone. But to make a stand here, even in the schools, against the tide of skepticism, we may rally many a veteran, who has wound through the labyrinths of modern learning. For instance. Dr. Price. (Controversy with Priestley, p. 54.) "Dr. Priestley, throughout a great part of his work, argues on the supposition, that according to the ideas of modern metaphysicians, spirit can have no relation to place, and is incapable of being present any where.—But I am certain, that Dr. Clark and some others of the best modern writers did not entertain these ideas of spirit. It is a maxim, which cannot be disputed, that time and place are

necessary to the existence of all things.—What is the nature of the relation of spirit to place, or in what manner it is present in space, I am utterly ignorant. But I can be sure, that if it exists at all, it must exist some *where*, as well as in some time."

Dr. Good. (Book Nat. Lec. 1, Ser. 3.) "Shall we take the quality of extension as the line of separation between what is material and what is immaterial? This, indeed, is the general and favorite distinction brought forward in the present day, but it is a distinction founded on mere conjecture, and which will by no means stand the test of inquiry.—If extension appertain not to the mind or thinking principle, the latter can have *no place* of existence, it can exist *no where*, for *where*, or *place* is an idea that cannot be separated from the idea of extension: and hence the metaphysical immaterialists of modern times freely admit, that the mind has *no place* of existence, that it does exist *no where;* while, at the same time, they are compelled to allow, that the immaterial Creator or universal spirit exists *every where*, substantially as well as virtually.—[But] In reality, under some kind of ethereal or shadowy make, under some refined, or spiritualized, and evanescent texture, it seems, in almost all ages and nations, to have been handed down by universal tradition, and contemplated by the great mass of the people, whatever may have been the opinion of the philosophers, as soon as it has become separated from the body.—In reality—there are few of immaterialists, who do not conceive in their hearts, that the soul, in its separate state, exists under some such shadowy and evanescent form; and that, if never suffered to make its appearance in the present day, it has thus occasionally appeared in earlier ages, and for particular purposes. Yet what can in this manner become manifest to material senses must have at least some of the attributes of matter in its texture, otherwise it could produce no sensible effect or recognition. From what remote source, universal tradition may have derived this common idea of disembodied spirits, I pretend not to ascertain; the inquiry would nevertheless oe curious, and might be rendered important; it is a pleasing

subject and embued with that tender melancholy, which peculiarly benefits it for a mind of sensibility and fine taste. Its universality, independently of the sanction afforded to it by revealed religion, is no small presumption of its being founded in fact."

Dr. More. (Antidote against Atheism, Ap. c. 10, s. 9, and Pref. Gen.) "If by extension be meant a juxta-position of parts, or placing them one by another as it is in matter, I utterly deny, that a spirit is in this sense at all extended. But if you mean only a certain amplitude of presence, that it can be at every part of so much matter at once, I say it is extended; for juxta-position of parts, impenetrability, and divisibility go together, and therefore, where the two former are wanting, extension implies not the third.—I have admitted a kind of extension in the nature of a spirit—but I can justly apologize for myself, that if there is no real entity but what is in some sense extended, it will be impossible not to conclude, that a spirit is in some sort extended, also." Glanvill, Chaplain royal; (in his Sadducismus Triumphatus, on the Nullibists, throughout.) Locke. (Es. B. 2, c. 13, s. 10, c. 26, s. 3.) "To say that the world is somewhere, means no more than that it does exist.—Time and place are the foundation of very large relations, and all finite beings, at least, are concerned in them." Baxter. (Inq. into Soul, vol. 2, s. 2.) "The nature or essence of things—their existence commences—with respect to a determined time and place. In the Universal Dic. or Cyclopedia, under the word, *existence*, it is observed, that the existence of created beings hath relation to time, place, and a cause." Le Clerc. (Ont. et Pneumat.)

Marquis D' Argens. (Impartial Phil. vol. 2, s. 8.) "Aristotle's philosophy, which became in vogue in the 12th century, was the cause of almost bringing back the divines to the opinion of Origen and Tertullian. They denied, it is true, in express terms, that the essence of spiritual substances had any thing corporeal therein, though ever so subtle, or any thing else, that related to matter, but—allowed extension to spirits—thus—until the Cartesians appeared, the explanations, which St. Augustine

had given of the pure immateriality of God, had been greatly diminished—nevertheless—St. Augustine allowed angels and even demons to be endued with bodies, and he allowed three or four kinds of spiritual substances; he made celestial substances to have one essence, and demons to have another, which he affirmed to be like a grosser kind of air. As for the human soul, he said it was formed of substance that was proper and peculiar to itself." M. Bayle. (Dic. Art. Simonides.) "Till the appearance of Descartes, all our doctors, whether divines or philosophers, had given extension to spirits.—The Cartesians have set aside all these opinions; they affirm, that spirits have no sort of extension or local presence, but their opinion has been rejected as very absurd."

Yet deductions of a very contrary nature may be adduced from modern theologians of a high name for religious character, however far they may have here swerved from scriptural simplicity out of superior defference to skeptical speculation, and which as certain plus-quantities, if not cancelled by the inconsistency of as many minus-quantities of an opposite character in speech or practice, can hardly rescue them from an imputation of infidel dogmatism. For instance. Dr. Watts. (Phil. Es. 6, s. 5.) "The infinite consciousness and activity of God, which are his very self, have no measurable or immeasurable relation either to body or to space, as the parts of extension have to each other: and therefore, we say *he is no place* in strict and philosophical language.—(sec. 3.) Upon the whole, as it cannot be conceived, how a power of thinking can have any contact with body, so neither can I conceive, in proper speech, how a being, whose nature consists in consciousness and activity without extension or shape, can have any nearness or juxta-position to body.—(s. 4.) Spirits have no such relation to place as bodies have, and therefore it may be philosophically said, that *they exist or reside no where.*"

Dr. Doddridge. (Lectures, prop. 84.) "There is no reason to believe, that if the soul be immaterial, it is extended.—To

this it is objected, that nothing acts but *where* it is: therefore, if the soul were not extended, it could not act at all—and that what is not extended is no where, and what is no where can have no existence. But though this has been generally allowed as a maxim, it is not self-evident"—but here breaking off suddenly, in another place (Prop. 4.) he says, "The soul is seated in the brain." Saurin. (Ser. on Omnip.) "God is in no place." Westminster Confession of Faith, and the Thirty-nine Articles. (Art. 1.) "There is but one living, and true God, everlasting, without body, parts, or passions;"—not but what the divine essence may be purer, more simple and refined than that of any other spirit, nor by any means partible—yet thus behold, how disgracefully Christianity has suffered from infidel speculation! how it has been sunk oftentimes below the spiritual faith of heathenism, even where it has been sometimes carried under pretence of dispelling darkness in this very particular!

And to this we may add another kind of modern degeneracy as of similar origin; one which has characterized the present as a "story-telling age." Works of fiction have hence inundated the reading public. And, indeed, how could such a perversion find better support than in a philosophy, which questions all reality except what consists in idea merely? and thus in fact ascribes a truth to the seductive impressions of fiction, superior to that of common sense? Hence lying has been erected into a profession, and thus attained a wide renown; to the most artful and extensive imposition on the tender mind; for how can one become interested in a work of fiction any further than he really believes in it, at least for the time being? And thus Christendom has indulged a perversion unheard-of and intolerated by heathenism of whatever age, or, at least, expressly discarded by their first philosophers; (Plato's Republic, B. 2, 3.) while scripture reckons "all liars" among "the skeptical, the abominable, murderers, whoremongers, sorcerers, idolaters"—(Rev. xxi. 8.)

THE ANCIENT AND POPULAR PNEUMATOLOGY.

Going out from Cartesianism, and ascending from its cloudy mists to the clear mountain-top, on whatever side we turn our eyes, we find the whole world in every age and clime to have been generally of one mind in regard to this momentous subject. But as we neither desire nor expect much credit for our own assertions merely, in order to instruct as well as confirm, we will adduce certain passages, in the first place, from Ancient Philosophy. As in every fond theory, however, so in the Intellectual System, appeal has been made to this source, as by Dr. Cudworth; but in vain, when that only has been regarded, which those sages may have said about certain nominal essences, or mere attributes of the soul, (as *νοος, εντελεχεια,* mens,) instead of the soul itself; (as *Πνεῦμα,* anima, רוח.) The ancients also sometimes apply the terms immaterial or incorporeal to spirit, yet it is well known, that this was a general way of speaking, whereby only a greater degree of subtility is intended: as for instance, where Aristotle calls fire, (De anima,) "the most incorporeal of all the elements." To begin then our deductions here—(ib. lib 2, c. 3.)

"The soul must be a substance, as well as the form of the natural body and possessed of life." Whence the Peripatetic soul is called "the substantial form of the human body"—how like the common idea of a ghost.—(lib. 1, c. 2.) "Some, indeed, say, that the soul is, in a peculiar sense, that which moves —Democritus says, that it is a certain fire and heat—in like manner, Leucippus—both think, that the soul is what affords

motion to animals—and the Pythagoreans appear to hold the same opinion. At least, some of them say, that the soul is that remnant which is in the air.—It appears to some to be a sort of fire. And in fact, this consists of the most subtile composition, and is the most incorporeal of the elements, while also it is moved, and a prime mover of other things.—But Diogenes, as some others also, thought it was air, regarding this as the most subtile of all things and a principle—Heraclitus said that the soul was a principle—a thing exceedingly incorporeal and ever moving—he and many others thought it essentially active."

Plato. (Laws, B. 12.) "The soul in the present life causes each of us to be what each of us is; the body follows each of us like an image." So Proclus, his ancient commentator, (on Timeus,) observes, that "as one surveying his shadow in the water—so the soul beholding the image of herself in body —thinks that she suffers though impassive—mistaking her image for herself—and is troubled and perplexed—as infants—or adults in dreaming." Porphyry says (Life of Plot.) of Plotinus, the Platonist, "Happy art thou, O Plotinus, who hast for thy lot a demon, a god of no inferior order, as a familiar director." So Bayle. (Dic. Art. Plot.) "Plotinus, knowing that his familiar spirit was of so eminent an order, directed with greater application the sight of his understanding towards him. He even composed a work concerning familiar spirits—I observe these things, that one may here see a small specimen of the Platonic doctrine concerning genii—and know, that the doctrine of guardian angels, so much spoken of in the church of Rome—is much more ancient than the Christian religion."

Jamblichus, entitled the divine. (De Mysteriis. sec. 2, c. 3.) "You ask, how we may know an apparition, whether it be a god, angel, archangel, demon, a principality, or a soul. I answer—the apparition of souls is of various appearance. But the gods shine with a refulgence pleasant to behold; archangels, in a manner terible, yet mild;—demons horrible—heros, milder than demons—souls, similar to heros but fainter.—Gods also

shine forth with incomparable beauty; petrify the beholder with admiration; instil a certain divine joy; display ineffable symmetry, and an indescribable majesty above all comparison. The vision of archangels is beatific, and of great beauty, but not so admirable and ineffable as that of the Gods. Angels are of a pulchritude still more imperfect."

Philoponus. (In Cudworth's Int. Sys. p. 736.) "The ancients affirm, that impure souls, after their departure out of this body, wander here up and down for a certain time in their spirituous, vapourous, and airy body, appearing about sepulchres, and haunting their former habitations.—And if it be demanded why it is, that this spirit appears—generally of human form, yet sometimes in the form of other animals, those ancients replied, that their appearing so frequently in human form, proceeded from their being—enstamped as it were with the form of the exterior body—and that their having sometimes different forms proceeded from the fantastic power of the soul itself, which can at pleasure transform this spiritual body into any shape. For being airy, when it is condensed and fixed, it becometh visible, and again invisible, and vanishing out of sight, when it is expanded and rarefied."

Porphyry. (ib. p. 734.) "Human souls are always united with some body or other.—And if Hades be taken for a subterranean and dark place, yet may the soul be said to go into Hades, because when it quits this gross, earthly body, a more spirituous and subtile body—doth still attend it.—The soul is never wholly naked of all body, but hath always some body or other joined with it, either a purer or impurer one, suitable and agreeable to its own present disposition. But at its first leaving this gross, earthly body, the spiritual body, which accompanieth it, must needs go away polluted and incrassated with the gross vapours and steams thereof, till the soul afterwards purging itself, by degrees, becomes at length a dry splendour, which hath no misty obscurity, nor casteth any shadow." Apollonius. (Life by Philos. and ib. B. 1, c. 5.) "Touch me and handle me, and if you find me

to avoid the touch, then may you conclude me to be a spirit or ghost; but if I firmly resist the same, then believe me really to live, and not yet to have cast off the body." Hierocles, (ib.) defined man to be "a rational soul," or being "with a coeval, immortal body," and taught, that "the terrestrial body" or 'mortal man' was nothing but "an image of the true man."

Let us now proceed to THE PRIMITIVE CHURCH. For instance. Justin Martyr. (Quest. Grec. ad Christ, &c.) "Every substance, which cannot be subjected to another because of its subtility, has nevertheless, a body, which constitutes its essence. If we say, that God is incorporeal, it is not because he really is so, but because we are accustomed to appropriate certain names to certain things to denote in the most respectful manner possible the attributes of the Deity.—Thus, because the essence of God is invisible, and does not come within the reach of our senses, we call it incorporeal." Tatian. (Oratio ad Grecos, &c.) "All the demons have bodies, which are not bodies of flesh, but of a spiritual substance, as of fire and air. These spiritual bodies are imperceptible to all except those, to whom God has given the power, and who are enlightened by his divine spirit."

Origen. (In Joan.) "Every spirit, according to the most exact and simple notion of this term, is a body."—(Poem. ad Princ.) "The term incorporeal is not to be found in any place of the sacred writings."—(Peri Archon, B. 2.) Thomas, "as well as the other apostles, assented to what the woman affirmed, who had seen Jesus, as not thinking it at all impossible for the soul of a dead man to be seen; but he did not believe him to have arisen in his former body, which is the antitype of the soul.—Not as though he doubted at all, that the body of a soul departed might be seen with the eyes of sense, wholly resembling that form, which it had before in this life, both in size, figure, colour, and voice; and oftentimes also in the same customary garments."

Tertullian. (Adversus Prax. c. 7.) "Who will deny that God is a body, though he is also a spirit? Every spirit is a body,

and has a form and shape proper to itself."—(De Anima, p. 309.) "What is that, which after its separation from this body, is carried down into Hades, and—there reserved until the day of judgement? And what is that, which Christ went down unto, when he died? I think to the souls of the patriarchs. But incorporeity is free from all custody or imprisonment, and devoid of pain or pleasure. Wherefore, if souls have any sense—after death—they must have some corporeity.—Nor is there any other than a human shape to be assigned to a human soul: or, indeed, than that of the body, which it before carried about." Tertulian also relates a vision of a certain, sister prophetess, in her own words. "There was, among other things, a soul corporeally exhibited to my view; it was tender, and lucid, and of an aerial colour, and in every way of human form."

St. Ireneus. (B. 2, c. 62.) "Our Lord hath most plainly taught us, that souls do not only continue after death, without passing from one body to another, but also preserve the figure of the body, in which they were before situated, and remember the actions and omissions of their past life, as in the scripture narration of the rich man and Lazarus." St. Gregory Nazianzen. (Orat. 34 and 40.) "Can we conceive of a spirit, without conceiving of motion and diffusion?—The light manifested to the disciples on the mountain was a small specimen of the divine." St. Clement of Alexandria. (Strom. lib. 5, p. 252.) "The Stoics say, that the appearance of a divine body, and a spirit in its essence is, indeed, like the breath which we inhale and exhale." St Augustine calls (Retrac. lib. 2, c. 11.) good angels, "happy and holy souls;" and says, (De gen. lib. 3, c. 10.) that "demons, before their transgression, had celestial bodies, as angels now have, yet afterwards, by way of punishment, they may have been changed into aerial ones, and such as now may suffer by fire."

As to *scripture*, our limits admit only of a reference to an abundant mass of testimony; such as the whole doctrine of angels and demons, their various appearances and possessions; the

spirits seen in vision, as the multitude of the justified in the Apocalypse; the inner man and the outer man; the celestial body, and the terrestrial body; the *natural body*, and the *spiritual body;* our putting off this tabernacle of the body, in which we groan and are burdened; the ghosts of the prophets on the mount of transfiguration; Christ, taken for a spirit while walking on the sea, and bidding his disciples to handle him after his resurrection in order to distinguish him from a mere spirit; Dives and Lazarus in Hades; the ghost of Samuel raised up by the necromancy of the witch of Endor; and that described by Eliphas, (Job iv. 12,) "when deep sleep falleth on men, fear came upon me and trembling, which made all my bones to shake. Then a spirit passed before my face; the hair of my flesh stood up. It stood still; but I could not discern the form thereof; an image was before mine eyes, and I heard a voice"—(So Is. xiv. 9, &c. Ez. xxxii. 18, &c. or more like the following.)

Let us, finally, cast an eye to THE PEOPLE, of every age and clime. Waving whatever has been said, done, or enacted upon this subject in English and European history, however remarkable or multifarious, (Hutch. Chr. Table,) let us first recur to antiquity. For instance. The age of Homer. (Odyssey, B. 11.)

"When then I had implored
With vows and prayers the nations of the dead,
Piercing the victims next, I turned them both
To bleed into the trench; then swarming came
From Erebus the shades of the deceased,
Brides, youths unwedded, seniors who had lived
Long time familiar with oppressive cares,
And girls afflicted never till they died.
Came also numerous warriours by the spear
In battle pierced with armour gore-distained,
And stalked in multitudes about the foss
With dreadful clamours; me pale horror seized—
I sat the while, and with my faulchion drawn,
Forbade the thronging ghosts to approach the blood—
The spirit first of my companion came—but I
Unmoved still waited, till my mother's shade approached;
—— thrice I sprang toward her by desire impetuous urged,

And thrice she flitted from between my arms,
Light as a passing shadow or a dream."

So in the age of Virgil. (Georgics, B. 4, l. 467, &c.)

"Entering the caverns of Tenaria, the gates
Profound of Hades, and the wood obscure
In fearful shade, he approached the realm of ghosts
And Pluto dread, and souls unmoved by human prayers.
But the thin shades, excited by the strains of Orpheus,
Figures devoid of light, came even from the depths
Infernal, as many thousand birds hie to the woods,
When Hesperus or chilly rain doth drive them
From the mountains; matrons, and men, and bodies
Of the brave, despoiled of life, and boys, and maids unwed,
And youths before the eyes of parents stretched
Upon the funeral pile."

Our Celtic ancestry. (Ancient Frag. in Davié's Celtic Res. p. 559.) "The clouds are composed of the souls of men, which have lately quitted the earth. They fly over the heads of armies. Their influence inspires courage, or strikes terror. These are they, who, in the obscurity of the night, and amongst silent forests, terrify mortals with long continued howlings, with apparitions, and luminous phantoms. Participating as yet of terrestrial affections, they mix themselves into the passions of men. Their agency is perceived in dreams and in panic terrors. In vain they endeavour to soar above the atmosphere; an irresistible force, a wall of sapphire, impedes their wing towards the purer spheres, which roll in the immensity of space. As soon as a new body is formed, they enter it with impatience, inhabit and give it animation." The term, Hades, signifying merely the invisible state, was located variously, it appears, by different nations, sometimes in the earth, sometimes in the air.

Ossian. (Fingal, B. 2.) "A dark stream of fire comes down from the hill. Crugal sat upon the beam; his robes are of the clouds of the hill; his eyes are like two decaying flames.

Dark is the wound on his breast. The stars dimly twinkled through his form; and his voice was like the sound of the distant stream. Dim and in tears he stood, and stretched his pale hand over the hero. Faintly he raised his feeble voice, like the gale of the reedy Lego; 'My ghost, O Connal, is on my native hills, but my corse is on the sands of Ullin. Thou shalt never talk with Crugal, nor find his lone steps on the heath. I am light as the blast of Cromla, and I move like the shadow of mist. Connal, son of Colgar, I see the dark cloud of death. It hovers over the plain of Lena. The sons of green Erin shall fall. Remove from the field of ghosts.' Like the darkened moon, he retired in the midst of the whistling blast." So the departure of Creusa's ghost, and the approach of the inspiring spirit in the cave of the Sybil, (Eneid,) and so in the descent on the apostles, "like a mighty rushing wind." But Ossian again—"Trenmar came from his hill at the voice of his mighty son. A cloud, like the steed of the stranger, supported his airy limbs. His robe is of the mist of Lano, that brings death to the people. His sword is a green meteor half extinguished. His face is without form and dark. He sighed thrice over the hero, and thrice the winds of the night roared around. He slowly vanished, like the mist that melts on the sunny hill."

Like the ghost of Crugal in tears with the semblance of his death-wound, and to forewarn of approaching woe, so that of Hector. (Eneid, B. 2, l. 268, &c.)

> "'Twas in the dead of night———
> When Hector's ghost before my sight appears,
> Shrouded in blood he stood and bathed in tears,
> Such as he was when by Pelides slain."———

Again—

> —— "the spectre no reply did frame
> But answered to the cause for which he came—
> O goddess-born! escape by timely flight
> The flames and horrors of this fatal night;

The foes already have possessed the wall,
Troy nods from high, and totters to her fall."

Again of the slain Creusa—

"Creusa still I call; at length she hears
And sudden through the shades of night appears;
Appears no more Creusa, nor my wife,
But a pale spectre, larger than the life.—
She spake; and glided by unseen in air—
Light as an empty dream at break of day,
Or as a blast of wind, she rushed away."

In coming down to later times, we may instance our American Aborigines. (Schoolcraft's Travels, c. 2.) "Manitto, in the Indian language, signifies *spirit*. They have good and bad manittos; great and small manittos; a manitto for every cave, waterfall, or other commanding object in nature, and generally make offerings at such places. All are more or less superstitious, and believe in miraculous transformations, ghosts, and witchcraft. They have jugglers and prophets, who predict events, who interpret dreams, and who perform incantations and mummeries." And the Rev. Heckewelder. (Hist. Trans. vol. i, c. 33.) "When a boy is to be initiated—he has interviews with the manitto, or with spirits, who inform him of what he was before he was born, and what he will be after his death.—The belief in the truth of these visions is universal among the Indians. —In funerals, (c. 37.)—a hole is left in the lid of the coffin.—This hole, the Indians say, is for the spirit of the deceased to go in and out, at pleasure, until it has found the place of its future residence.—The doctors or jugglers—(c. 31.)—pretend to counteract or destroy the enchantments of wizzards or witches, and expel evil spirits."

Polynesians. (Cook's Voyages, vol. i., B. 2, c. 11.) Friendly Islanders. "They say, that immediately upon death, the souls of their chiefs separate from their bodies, and go to a place called Boolootoo—the general receptacle of the dead, according to their mythology, was never seen by any person; and yet, it

seems, they know that it lies to the westward of Feegee, and that they, who are once transported thither, live forever.—As to the souls of the lower sort of people, they undergo a kind of transmigration." Otaheitans. (Ib. vol. ii., B. 3, c. 9.)—" They speak of spirits being in some measure not totally divested of those passions, which actuated them when combined with material vehicles. Thus, if souls, who were formerly enemies, should meet, they have many conflicts; though it should seem to no purpose, as they are accounted invulnerable in this invisible state. There is a similar reasoning with regard to the meeting of man and wife. If the husband dies first, the soul of his wife is known to him on arrival in the land of spirits.—But what is most singular, they maintain, that not only other animals, but trees, fruit, and even stones have souls, which, at death, or upon being consumed, or broken, ascend to the divinity, with whom they first mix, and afterwards pass into the mansion allotted to each.—They are startled in the night on approaching a Toopapoo, where the dead are exposed, in the same manner, that many of our ignorant and superstitious people are, with the apprehension of ghosts and at the sight of a church-yard; and they have an equal confidence in dreams, which they suppose to be communications from either their God, or from the spirits of their departed friends, enabling those favoured with them to foretel future events." And in the Missionary Voyage—(Appendix.) " Each family has its Tee, or guardian spirit; he is supposed to be one of their departed relatives, who, for his superior excellencies, has been exalted to an Eatooa. They suppose this spirit can inflict sickness or remove it.—Respecting a future state, they suppose no person perishes, or becomes extinct.—The evil demon, named Tee, has no power but on earth; and this he exercises, by getting into them with their food, and causing madness or other diseases; but these, they imagine, their tutelar saints if propitious can prevent or remove.—With regard to their worship, Capt. Cook does the Otaheitans but justice, in saying, that they reproach many, who bear the name of Christians."

The Hottentots. (Kolben's Hist. Hot. vol. 1, c. 10.) "They offer prayers and praises to the good Hottentots departed. They are apprehensive of the return of departed spirits to molest them. They, therefore, upon the death of any man, woman, or child of them, remove with their Kraals, bag and baggage, to a new settlement, believing that the dead never haunt any places but those they died in.—They believe, that it is in the power of their wizzards or witches to lay a spirit"—

Mountains of the Moon. (Bruce's Trav. vol. iii., B. 6, c. 19.) "I asked the priest, [of the Nile,] into whose good graces I had purposely insinuated myself, if ever any spirit had been seen by him? He answered without hesitation, Yes, very frequently. He said he had seen *the spirit*, the evening of the third, just as the sun was setting, under a tree, which he showed me at a distance, who told him of the death of a son, and also that a party from Fasil's army was coming.—He said it was of a very graceful figure and appearance—but he seldom chose to look at his face.—I asked him, how he was certain it was not a man? He laughed, or rather sneered, shaking his head, and saying, No, no, it is no man, but a spirit."

The New-Hollanders, even the geographer characterizes, as "a poor, superstitious race, believing in ghosts and witches," and speaks of the Laplander's wizzard drum and black cat, and of the metempsychosis of the East. Nor is there any thing less remarkable in the Arabian and Mahometan pneumatology, as may be easily gathered from the Koran and Arabian Nights. Of the Tartars, Ledyard observes, (Life by Sparks, c. 11.) that "The images in the Russian houses, which I should take for a kind of household gods, are very expensive.—To furnish out a house properly with these *Dii Minores* would cost a large sum. When burnt out, as I have witnessed several times, the people have appeared more anxious for these than for any thing else."—So Laban's Penates; all heathen idols being probably intended as some material representation of the spirits or demons, that were worshipped under this semblance. (See also Farmer on

the Worship of Human Spirits, throughout.) The Scotch pneumatology also, as celebrated in the verse of Scott, and more particularly described in his notes thereupon, is of the same general character, and very different from that of the latter, metaphysical professors of this country. (See too Campbell's Notes on his Lochiel.) "Nor think," says the above author, (Rokeby, Canto 2.)

> "Nor think to village swains alone
> Are these unearthly terrors known,
> For not to rank nor sex confined
> Is this vain ague of the mind.
> Hearts firm as steel, as marble hard,
> 'Gainst *faith*, and *love*, and *pity* barred,
> Have quaked, like aspen leaves of May,
> Beneath its *universal sway*."

We may add, in fine, the following words of the learned Le Clerc. (Pneumatologia, sec. 2, c. 1.) "The ancient Chaldeans, as well as the Platonists and Pythagoreans, appear to have attributed body to all spirits—Through the whole East has this opinion prevailed, that indeed, besides the Supreme God, there are innumerable other inferior minds engaged in the administration of his universe; minds, which have often been sent to man—But in such a manner as either they were conspicuous or not; so that they may do many things without man's notice, and many things also when seen by him; in a form for the most part human, but more august and holy. The Greeks relate the like of their divinities, as is every where seen in their poets and historians. And although many falsehoods may be mixed with these relations, and it may not be sufficiently evident what is true, and what false, yet it is *presumptuous* to reject them all, as many do. We are not able to show in any way from the nature of things, that it is impossible for spirits to be conjoined with a thin body; nor is it probable that so many nations, so far separated in place and opinions, would have forged, as if by compact, all they have said of the apparition of spirits—the testimony of the Hebrews alone—is sufficient to establish the fact." The idea of the spir-

itual body being only a vehicle of the soul, appears to be, as Priestley observes, a wholly modern fiction. It arose probably from mistaking a mere attribute, or nominal essence, (as mens, νοος,) inhering in the substance of the soul, for this substance itself.

THE END.